Noncovalent functionalization of reduced graphene oxide with pluronic F127 and its nanocomposites with gum arabic

Nanocomposites of pluronic F127 modified reduced graphene oxide (PF127-rGO) with polyethylene glycol plasticize gum arabic (PGA) was prepared by evaporating an aqueous solution mixture of PF127-rGO and PGA. PF127-rGO was synthesized by the in-situ reduction of graphene oxide using hydrazine in presence of pluronic F127 and characterized by the Uv–Vis spectroscopy, transmission electron microscopy (TEM), wide angle x-ray scattering (WAXS), Fourier transforms infrared spectroscopy (FTIR), thermogravimetric analysis (TGA) and Raman spectroscopy. The Uv–Vis and Raman spectroscopy results indicate that pluronic F127 functionalization does not hamper the structure of rGO, and TEM image indicates, the pluronic F127 anchored rGO sheets remain exfoliated in diluted aqueous solution of PF127-rGO. WAXS, FTIR and TGA studies confirms the functionalization of rGO with pluronic F127. PF127-rGO 2.5, PF127-rGO 5 and PF127-rGO 7.5 nanocomposites were fabricated, where the numbers represent the weight percentage of PF127-rGO with respect to PGA. The composite films were characterized by field emission scanning electron microscopy (FESEM), FTIR, WAXS and mechanical property study. FESEM and WAXS studies show good dispersion of PF127-rGO sheets in the PGA matrix. The FTIR results indicate a significant interaction between functional groups of PF127-rGO and functional groups of PGA. PF127-rGO 7.5 shows a 124% increase of stress at break and 185% increase of Young's modulus compared to pure PGA.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Materials Science, Research group: Plastics and Elastomer Technology, Khulna University of Engineering & Technology (KUET), Chonbuk National University, Swinburne University of Technology
Authors: Layek, R. K., Uddin, M. E., Kim, N. H., Tak Lau, A. K., Lee, J. H.
Number of pages: 9
Pages: 155-163
Publication date: 1 Nov 2017
Peer-reviewed: Yes

Publication information
Journal: Composites Part B : Engineering
Volume: 128
ISSN (Print): 1359-8368
Ratings:
Scopus rating (2016): SJR 2.05 SNIP 2.294 CiteScore 5.19
Scopus rating (2015): SJR 2.007 SNIP 2.209 CiteScore 4.29
Scopus rating (2014): SJR 1.96 SNIP 2.393 CiteScore 3.87
Scopus rating (2013): SJR 1.38 SNIP 2.458 CiteScore 3.31
Scopus rating (2012): SJR 1.215 SNIP 2.128 CiteScore 2.58
Scopus rating (2011): SJR 1.105 SNIP 2.497 CiteScore 2.49
Scopus rating (2010): SJR 1.269 SNIP 2.206
Scopus rating (2009): SJR 1.253 SNIP 1.878
Scopus rating (2008): SJR 1.086 SNIP 1.7
Scopus rating (2007): SJR 1.271 SNIP 2.207
Scopus rating (2006): SJR 1.258 SNIP 2.138
Scopus rating (2005): SJR 1.045 SNIP 1.695
Scopus rating (2004): SJR 1.013 SNIP 1.309
Scopus rating (2003): SJR 1.129 SNIP 1.348
Scopus rating (2002): SJR 1.392 SNIP 1.107
Scopus rating (2001): SJR 0.942 SNIP 1.116
Scopus rating (2000): SJR 0.707 SNIP 1.062
Scopus rating (1999): SJR 0.756 SNIP 0.896
Original language: English
ASJC Scopus subject areas: Ceramics and Composites, Mechanics of Materials, Mechanical Engineering, Industrial and Manufacturing Engineering
Keywords: Electron microscopy, Mechanical properties, Nano-structures, Polymer-matrix composites (PMCs), Thermal analysis
DOIs:
10.1016/j.compositesb.2017.07.010
Source: Scopus
Source-ID: 85024888498
Research output: Scientific - peer-review › Article
Methane thermal decomposition in regenerative heat exchanger reactor: Experimental and modeling study

In this work, thermal decomposition of methane (TDM) was experimentally studied at nominal gas temperatures of 1070 K–1450 K in a non-catalytic laboratory test reactor. The purpose was to use a simple kinetic mechanism to describe the TDM reaction, which could be applied in industrial reactor design. The experimental data was utilized to optimize global kinetic parameters describing the TDM reaction in the test reactor. For comparison, a 37-step reaction mechanism for TDM was adopted from the literature. When analyzing experimental datasets from the literature, the optimized global kinetics provided better agreement with the experimental data than the 37-step mechanism when the reactor temperature profiles were defined in detail. Since the 37-step mechanism was not able to predict the solid carbon formation well enough, the mechanism was slightly adjusted according to a reaction flow and sensitivity analysis. Additionally, it was suggested that the 37-step mechanism can be improved by optimizing the reaction mechanism by using a detailed experimental data of hydrocarbon formation in TDM achieved in an environment where the temperature profiles are fully defined.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Chemistry and Bioengineering, Research group: Bio- and Circular Economy, Norwegian University of Science and Technology, NTNU
Authors: Keipi, T., Li, T., Løvås , T., Tolvanen, H., Konttinen, J.
Pages: 823-832
Publication date: 15 Sep 2017
Peer-reviewed: Yes

Publication information
Journal: Energy
Volume: 135
ISSN (Print): 0360-5442
Ratings:
Scopus rating (2016): SJR 1.999 SNIP 1.798 CiteScore 5.17
Scopus rating (2015): SJR 2.276 SNIP 2.046 CiteScore 5.03
Scopus rating (2014): SJR 2.647 SNIP 2.63 CiteScore 5.7
Scopus rating (2013): SJR 2.54 SNIP 2.593 CiteScore 5.02
Scopus rating (2012): SJR 1.998 SNIP 2.25 CiteScore 4.25
Scopus rating (2011): SJR 1.609 SNIP 2.043 CiteScore 4
Scopus rating (2010): SJR 1.814 SNIP 2.725
Scopus rating (2009): SJR 1.729 SNIP 2.313
Scopus rating (2008): SJR 1.106 SNIP 1.444
Scopus rating (2007): SJR 0.913 SNIP 1.481
Scopus rating (2006): SJR 0.875 SNIP 1.306
Scopus rating (2005): SJR 0.965 SNIP 1.203
Scopus rating (2004): SJR 0.711 SNIP 1.115
Scopus rating (2003): SJR 1.093 SNIP 1.496
Scopus rating (2002): SJR 0.952 SNIP 1.287
Scopus rating (2001): SJR 1.091 SNIP 1.078
Scopus rating (2000): SJR 0.82 SNIP 0.992
Scopus rating (1999): SJR 0.632 SNIP 0.659
Original language: English
Keywords: CCS, Hydrogen production, Kinetics, Methane cracking, Methane decomposition
DOIs:
10.1016/j.energy.2017.06.176
Research output: Scientific - peer-review › Article

Engineering and Characterization of Bacterial Nanocellulose Films as Low Cost and Flexible Sensor Material

Some bacterial strains such as Komagataeibacter xylinus are able to produce cellulose as an extracellular matrix. In comparison to wood-based cellulose, bacterial cellulose (BC) holds interesting properties such as biodegradability, high purity, water-holding capacity, and superior mechanical and structural properties. Aiming toward improvement in BC production titer and tailored alterations to the BC film, we engineered K. xylinus to overexpress partial and complete bacterial cellulose synthase operon that encodes activities for BC production. The changes in cell growth, end metabolite, and BC production titers from the engineered strains were compared with the wild-type K. xylinus. Although there were no significant differences between the growth of wild-type and engineered strains, the engineered K. xylinus strains demonstrated faster BC production, generating 2–4-fold higher production titer (the highest observed titer was obtained with K. xylinus-bcsABCD strain producing 4.3 ± 0.46 g/L BC in 4 days). The mechanical and structural characteristics of
cellulose produced from the wild-type and engineered K. xylinus strains were analyzed with a stylus profilometer, in-house built tensile strength measurement system, a scanning electron microscope, and an X-ray diffractometer. Results from the profilometer indicated that the engineered K. xylinus strains produced thicker BC films (wild type, 5.1 μm, and engineered K. xylinus strains, 6.2–10.2 μm). Scanning electron microscope revealed no principal differences in the structure of the different type BC films. The crystallinity index of all films was high (from 88.6 to 97.5%). All BC films showed significant piezoelectric response (5.0–20 pC/N), indicating BC as a promising sensor material.
Tailored Fabrication of Transferable and Hollow Weblike Titanium Dioxide Structures

The preparation of weblike titanium dioxide thin films by atomic layer deposition on cellulose biotemplates is reported. The method produces a TiO2 web, which is flexible and transferable from the deposition substrate to that of the end application. Removal of the cellulose template by calcination converts the amorphous titanias to crystalline anatase and gives the structure a hollow morphology. The TiO2 webs are thoroughly characterized using electron microscopy, X-ray diffraction, and X-ray photoelectron spectroscopy to give new insight into manufacturing of porous titanium dioxide structures by means of template-based methods. Functionality and integrity of the TiO2 hollow weblike thin films were successfully confirmed by applying them as electrodes in dye-sensitized solar cells.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Chemistry and Bioengineering, Research group: Supramolecular photochemistry, Optoelectronics Research Centre, Research group: Surface Science, Department of Materials Science, Research group: Plastics and Elastomer Technology
Number of pages: 8
Pages: 64-71
Publication date: 2017
Peer-reviewed: Yes
Early online date: 16 Nov 2016

Publication information
Journal: ChemPhysChem
Volume: 18
ISSN (Print): 1439-4235
Ratings:
Scopus rating (2016): SJR 1.264 SNIP 0.771 CiteScore 2.81
Scopus rating (2015): SJR 1.334 SNIP 0.912 CiteScore 3.21
Zinc oxide films with three types of topographies: needle-like and hexagonal rods and flakes, were prepared by hydrothermal synthesis on stainless steel substrates to investigate their photocatalytic and antibacterial properties. The photocatalytic activity was measured with a methylene blue (MB) discoloration test, whereas a method using bioluminescent whole cell bacterial biosensors enabling the constant monitoring of the amount of living cells on the surfaces was used here to study the antibacterial properties. The results showed that photocatalytic activity was clearly influenced by the surface area, which is in turn dependent on the topography. Moreover, it was found that all the examined films decreased notably the amount of Staphylococcus aureus and Escherichia coli on the surfaces. Despite significant differences in the surface areas of the studied samples that led to different zinc dissolution rate in aqueous environment, no notable differences in antibacterial activity between the films with different morphologies could be detected. These results are presented and discussed in this paper.
Thermo-catalytic decomposition of methane: The effect of reaction parameters on process design and the utilization possibilities of the produced carbon

The study presents a path for selecting the reaction and reactor parameters of a process applying thermo-catalytic decomposition of methane (TDM). Temperature and catalyst are the main reaction parameters affecting the type of TDM carbon and defining the reaction’s theoretical heat requirement. Secondly, the reaction parameters affect the reactor design including the selection of reactor type and heating source as well as the reactor dimensioning. The reactor dimensioning is discussed by highlighting the methane residence time requirement at different reaction conditions. Finally, the economic value of the TDM products is analyzed. According to the analyses, the reaction temperature and catalyst have a significant effect on reactor design and on the value and utilization possibilities of the TDM carbon. The prices of carbon products vary greatly as does the global demand of those. The utilization possibilities of carbon highly affect the overall viability of the TDM process and therefore should be carefully considered during process design.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Chemistry and Bioengineering, Research group: Power Plant and Combustion Technology Technology
Authors: Keipi, T., Tolvanen, K. E., Tolvanen, H., Konttinen, J.
Number of pages: 12
Pages: 923-934
Publication date: Oct 2016
Peer-reviewed: Yes

Publication information
Journal: Energy Conversion and Management
Volume: 126
ISSN (Print): 0196-8904
Ratings:
Scopus rating (2016): SJR 2.287 SNIP 2.065 CiteScore 6.04
Scopus rating (2015): SJR 2.09 SNIP 2.092 CiteScore 5.24
Scopus rating (2014): SJR 1.854 SNIP 2.835 CiteScore 5.35
Scopus rating (2013): SJR 1.669 SNIP 2.558 CiteScore 4.49
Scopus rating (2012): SJR 1.732 SNIP 2.277 CiteScore 3.72
Scopus rating (2011): SJR 1.292 SNIP 1.846 CiteScore 3.03
Scopus rating (2010): SJR 1.372 SNIP 1.75
Scopus rating (2009): SJR 1.339 SNIP 1.797
Sustainable nutrients recovery and recycling by optimizing the chemical addition sequence for struvite precipitation from raw swine slurries

Livestock farming contributes heavily to nitrogen (N) and phosphorus (P) flows into the environment, a major cause of eutrophication of coastal and freshwater systems. Furthermore, the growing demand for N-P fertilizers is increasing the emission of anthropogenic reactive N into the atmosphere and the depletion of the current P reserves. Therefore, it is essential to minimize the anthropogenic impact on the environment and recycle the wasted N-P for agricultural reuse. This study focused on enhancing struvite (MgNH₄PO₄·6H₂O) precipitation from raw swine slurries in batch and laboratory-scale reactors. Different chemical addition sequences were evaluated, and the best removal efficiency (E%) was obtained when the chemicals were mixed before the precipitation process. Struvite was detected at a pH as low as 6 (E%N-P∼50%), and high E%N-P was found at pH 7–9.5 (80–95%). Furthermore, air stripping was used in place of NaOH to adjust pH, returning the same efficiency as if only alkali had been used. XRD and FE-SEM analysis of the precipitate showed that the recovered struvite was of high purity with orthorhombic crystalline structure and only trace amounts of impurities from matrix organics, co-precipitation products (CaO and amorphous calcium-phosphates), and residuals of added chemicals (MgO).

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Chemistry and Bioengineering, Department of Materials Science
Authors: Taddeo, R., Koippo, K., Lepistö, R.
Number of pages: 7
Pages: 52-58
Publication date: 15 Sep 2016
Peer-reviewed: Yes

Publication information
Journal: Journal of Environmental Management
Volume: 180
ISSN (Print): 0301-4797
Ratings:
Scopus rating (2016): SJR 1.141 SNIP 1.779 CiteScore 4.28
Scopus rating (2015): SJR 1.19 SNIP 1.717 CiteScore 3.86
Scopus rating (2014): SJR 1.228 SNIP 1.921 CiteScore 3.62
Scopus rating (2013): SJR 1.203 SNIP 2.014 CiteScore 3.84
Scopus rating (2012): SJR 1.377 SNIP 2.513 CiteScore 4.01
Scopus rating (2011): SJR 1.206 SNIP 2.181 CiteScore 3.66
Scopus rating (2010): SJR 1.13 SNIP 1.704
Scopus rating (2009): SJR 0.951 SNIP 1.718
Scopus rating (2008): SJR 0.75 SNIP 1.317
Scopus rating (2007): SJR 0.909 SNIP 1.46
Scopus rating (2006): SJR 0.813 SNIP 1.381
Scopus rating (2005): SJR 0.663 SNIP 1.088
Scopus rating (2004): SJR 0.532 SNIP 1.05
Characterization of endoglucanase rich Trichoderma reesei cellulase mixtures and their effect on alkaline solubility of dissolving pulp

Dissolving grade pulps are used to manufacture regenerated cellulosic fibres. One promising process for the production of regenerated fibres utilises endoglucanase rich cellulases in the modification of dissolving pulp into alkaline soluble form. The aim of this paper was to characterise cellulases produced by Trichoderma reesei that are available in large quantities and study their effect on the dissolving grade softwood pulp, especially on its alkaline solubility. All the studied cellulases had endoglucanase activity and they decreased the intrinsic viscosity of the pulp. The degradation of cellulose into solubilised sugars increased with the cellulases containing also cellobiohydrolases. The monocomponent endoglucanases enhanced alkaline solubility of the pulp more than the multicomponent cellulases and produced alkaline solutions with higher fluidity. The studies showed that the type of the cellulases in the enzyme mixture has significant effect on the amount of solubilised sugars during the enzyme treatment and on the alkaline solubility of the pulp.
Improving Recovery Boiler Availability through Understanding Fume Behavior

Unexpected recovery boiler shutdowns are rare, but they can cost millions of dollars in lost income. Sometimes the inorganic compounds in black liquor can cause sudden fouling or plugging problems that could not be predicted beforehand. The ash particles can be divided into two main types and size classes: carryover and fume. This paper focuses on the smaller fume particles that form through the condensation of alkali metal vapors, and that deposit via different mechanisms than carryover. The location of fume deposition depends on several factors, such as flue gas and superheater temperatures, black liquor composition, and the flow field in the boiler.

This paper presents results obtained with a computational method that simulates fume formation in recovery boilers. The results in this paper focus on the effect of black liquor composition and elemental release on fume behavior, and the paper suggests how these observations should be taken into account when designing new boilers or retrofits. Moreover, the paper introduces the possible applications of the modeling method. These include, for example, troubleshooting of fouling problems in existing boilers, designing superheater configurations for new boilers, and positioning soot blowers.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Chemistry and Bioengineering, Research group: Power Plant and Combustion Technology, Valmet Technologies Oy
Authors: Leppänen, A., Välimäki, E.
Pages: 187-193
Publication date: Mar 2016
Peer-reviewed: Yes

Publication information
Journal: TAPPI Journal
Volume: 15
Issue number: 3
ISSN (Print): 0734-1415
Ratings:
Scopus rating (2016): SJR 0.406 SNIP 0.494
Scopus rating (2015): SJR 0.441 SNIP 0.741
Scopus rating (2014): SJR 0.44 SNIP 0.625
Scopus rating (2013): SJR 0.429 SNIP 0.722
Scopus rating (2012): SJR 0.326 SNIP 0.809
Scopus rating (2011): SJR 0.545 SNIP 1.05
Scopus rating (2010): SJR 0.737 SNIP 1.353
Scopus rating (2009): SJR 1.156 SNIP 0.755
Scopus rating (2008): SJR 0.838 SNIP 1.091
Scopus rating (2007): SJR 1.561 SNIP 1.188
Scopus rating (2006): SJR 1.205 SNIP 1.322
Scopus rating (2005): SJR 0.857 SNIP 0.97
Scopus rating (2004): SJR 1.185 SNIP 0.988
Scopus rating (2003): SJR 0.797 SNIP 0.709
Scopus rating (2002): SJR 1.275 SNIP 1.811
Scopus rating (2001): SJR 0.477 SNIP 1.424
Scopus rating (2000): SJR 0.652 SNIP 0.927
Scopus rating (1999): SJR 0.769 SNIP 0.791
Original language: English
Research output: Scientific - peer-review › Article
Machine-coated starch-based dispersion coatings prevent mineral oil migration from paperboard
Mineral oil migration through paperboard presents a safety risk in modern food packaging. This study aimed to enhance the safety of fiber-based packaging by utilizing a bio-based composite barrier layer to protect against mineral oil. Starch-clay composite coatings on paperboard were created via dispersion coating. Thermal analysis of the coating components and field emission scanning electron microscopy imaging were performed to ascertain the physicochemical properties and morphology of the coatings. Coating functionality was evaluated using contact angles and transmission rate (water and oxygen) measurements. The packaging safety focus was implemented by measuring the gas phase migration of heptane and analyzing the migration of liquid mineral oil through the coated paperboards with FTIR. The functional properties of the coated paperboards were maintained or improved. The studied coatings were effective barriers against the migration of mineral oil and could hence improve the barrier properties and safety of fiber-based primary food packaging.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Paper Converting and Packaging
Authors: Koivula, H. M., Jalkanen, L., Saukkonen, E., Ovaska, S., Lahti, J., Christophliemk, H., Mikkonen, K. S.
Pages: 173-181
Publication date: 2016
Peer-reviewed: Yes

Publication Information
Journal: Progress in Organic Coatings
Volume: 99
ISSN (Print): 0300-9440
Ratings:
Scopus rating (2016): SJR 0.852 SNIP 1.3 CiteScore 2.89
Scopus rating (2015): SJR 0.849 SNIP 1.39 CiteScore 2.84
Scopus rating (2014): SJR 0.992 SNIP 1.566 CiteScore 2.8
Scopus rating (2013): SJR 1.03 SNIP 1.663 CiteScore 2.58
Scopus rating (2012): SJR 1.043 SNIP 1.862 CiteScore 2.39
Scopus rating (2011): SJR 0.884 SNIP 1.606 CiteScore 2.34
Scopus rating (2010): SJR 0.983 SNIP 1.537
Scopus rating (2009): SJR 0.867 SNIP 1.333
Scopus rating (2008): SJR 0.829 SNIP 1.298
Scopus rating (2007): SJR 1.088 SNIP 1.362
Scopus rating (2006): SJR 1.243 SNIP 1.598
Scopus rating (2005): SJR 0.928 SNIP 1.168
Scopus rating (2004): SJR 0.692 SNIP 1.121
Scopus rating (2003): SJR 0.604 SNIP 1.497
Scopus rating (2002): SJR 1.037 SNIP 1.312
Scopus rating (2001): SJR 0.619 SNIP 0.92
Scopus rating (2000): SJR 0.857 SNIP 1.132
Scopus rating (1999): SJR 0.723 SNIP 1.167
Original language: English
Keywords: Mineral oil migration; Barrier; Dispersion coating; Paperboard; Food packaging
DOIs: 10.1016/j.porgcoat.2016.05.017
Research output: Scientific - peer-review › Article

Remarkable Dependence of the Final Charge Separation Efficiency on the Donor-Acceptor Interaction in Photoinduced Electron Transfer
The unprecedented dependence of final charge separation efficiency as a function of donor-acceptor interaction in covalently-linked molecules with a rectilinear rigid oligo-p-xylene bridge has been observed. Optimization of the donor-acceptor electronic coupling remarkably inhibits the undesirable rapid decay of the singlet charge-separated state to the ground state, yielding the final long-lived, triplet charge-separated state with circa 100% efficiency. This finding is extremely useful for the rational design of artificial photosynthesis and organic photovoltaic cells toward efficient solar energy conversion.

General information
This paper presents a techno-economic analysis of four concepts that apply the thermal decomposition of methane (TDM) with the aim of reducing carbon dioxide emissions in natural gas combustion. Different technical solutions are applied to convert methane in natural gas to gaseous hydrogen, which is combusted to produce electricity with a steam power cycle, and solid carbon, which is assumed to be sold as carbon black. The cost of electricity production and the potential to reduce CO₂ emissions in each concept were evaluated and compared to the reference case of direct methane combustion. With a moderate emission allowance price (20 €/tCO₂) and product carbon price (500 €/tcarbon) the cost of electricity production in the concepts was 12–58% higher than in the reference case. However, the price of product carbon had a significant effect on the feasibility of the concepts. Thus, the methane burner, which showed the best performance, produced 17% less CO₂ emissions per MWhₑ and had a smaller cost of electricity production than the reference case already with the carbon price of 600–700 €/tcarbon.
Corrosion products of carbonation induced corrosion in existing reinforced concrete facades

Active corrosion in reinforced concrete structures is controlled by environmental conditions and material properties. These factors determine the corrosion rate and type of corrosion products which govern the total achieved service life. The type and critical amount of corrosion products were studied by electron microscopy and X-ray diffractometry on concrete and reinforcement samples from existing concrete facades on visually damaged locations. The corrosion products in outdoor environment exposed concrete facades are mostly hydroxides (Feroxyhite, Goethite and Lepidocrocite) with a volume ratio to Fe of approximately 3. The results can be used to calibrate calculation of the critical corrosion penetration of...
Enhanced pre-treatment of cellulose pulp prior to dissolution into NaOH/ZnO

As a result of the constantly growing demand for textile fibres interest in utilising cellulose pulps for manufacturing regenerated cellulose fibres is growing. One promising water-based process for the manufacture of regenerated cellulose products is the Biocelsol process based on an NaOH/ZnO solvent system. The drawback of the Biocelsol process is the need for pre-treatment of the pulp, i.e. long mechanical pre-treatment (up to 5 h) followed by a 2–3-h enzymatic hydrolysis utilising a rather high amount of cellulolytic enzymes. In this work more efficient conditions to carry out the pre-treatment of cellulose pulp prior to dissolution into NaOH/ZnO are presented. Based on the results, cellulase treatment, when carried out in an extruder, can be used to effectively open up and fibrillate the fibres without completely destroying the fibre structure. The molar mass of the pulp treated enzymatically in an extruder was 14 % lower as compared to the state-of-
the-art-treated cellulose. As a consequence, the alkaline solutions prepared from the pulp treated enzymatically in an extruder had clearly lower dope viscosities regarding the cellulose content than the solutions prepared from the state-of-the-art-treated pulp. This enabled increasing the cellulose content in the dope up to 7 % (w/w) without increasing the dope viscosity.

**General information**

**State:** Published

**Ministry of Education publication type:** A1 Journal article-refereed

**Organisations:** Department of Materials Science, Research group: Fibre Materials, Department of Forest Products Technology, VTT Technical Research Centre of Finland, Aalto University

**Authors:** Grönqvist, S., Kamppuri, T., Maloney, T., Vehviläinen, M., Liitiä, T., Suurnäkki, A.

**Number of pages:** 10

**Pages:** 3981-3990

**Publication date:** Dec 2015

**Peer-reviewed:** Yes

**Publication information**

**Journal:** Cellulose

**Volume:** 22

**Issue number:** 6

**ISSN (Print):** 0969-0239

**Ratings:**

- Scopus rating (2016): CiteScore 3.68 SJR 1.126 SNIP 1.144
- Scopus rating (2015): SJR 1.153 SNIP 1.24 CiteScore 3.55
- Scopus rating (2014): SJR 1.071 SNIP 1.334 CiteScore 3.58
- Scopus rating (2013): SJR 1.127 SNIP 1.48 CiteScore 3.83
- Scopus rating (2012): SJR 1.179 SNIP 1.71 CiteScore 3.74
- Scopus rating (2011): SJR 1.354 SNIP 1.795 CiteScore 3.99
- Scopus rating (2010): SJR 0.873 SNIP 1.384
- Scopus rating (2009): SJR 1.038 SNIP 1.219
- Scopus rating (2008): SJR 0.926 SNIP 1.123
- Scopus rating (2007): SJR 0.754 SNIP 1.034
- Scopus rating (2006): SJR 0.699 SNIP 1.15
- Scopus rating (2005): SJR 1.112 SNIP 1.318
- Scopus rating (2004): SJR 0.855 SNIP 1.072
- Scopus rating (2003): SJR 0.81 SNIP 1.02
- Scopus rating (2002): SJR 0.649 SNIP 0.689
- Scopus rating (2001): SJR 0.602 SNIP 0.785
- Scopus rating (2000): SJR 0.583 SNIP 0.773
- Scopus rating (1999): SJR 0.67 SNIP 1.14

**Original language:** English

**Keywords:** Biocelsol, Cellulose dissolution, Dissolving pulp, Enzymatic hydrolysis, Porosity, Pre-treatment, Solute exclusion

**ASJC Scopus subject areas:** Polymers and Plastics

**DOIs:**

10.1007/s10570-015-0742-8

**Links:**


**Source:** Scopus

**Source-ID:** 84942026378

**Research output:** Scientific - peer-review » Article

**Cracking resistance of Cr3C2–NiCr and WC–Cr3C2–Ni thermally sprayed coatings under tensile bending stress**

The cracking behaviour of Cr3C2–25(Ni20Cr) and WC–20Cr3C2–7Ni thermally sprayed coatings during tensile load in 3-point bending tests was studied by Acoustic Emission (AE) monitoring and microstructure post-analysis. The AE monitoring reveals a superior resistance against cracking in the WC–Cr3C2–Ni coatings compared to Cr3C2–NiCr. The incorporation of tungsten carbides beneficially affects the residual stress state of the coatings and has an impact on the detailed fracture mode. The results hold for both as-sprayed as well as ground and polished coatings.

**General information**

**State:** Published
The Effect of Phosphorus Exposure on Diesel Oxidation Catalysts-Part I: Activity Measurements, Elementary and Surface Analyses

The effects of phosphorus poisoning on the activity of PtPd and Pt diesel oxidation catalysts and on the activity of the support material were investigated using the gas phase laboratory-scale-aging procedure. The catalysts were treated using two different phosphorus concentrations (0.065 and 0.13 mol/L (NH4)(2)HPO). The deactivation was studied by inductively coupled plasma optical emission spectroscopy, electron microscopy, X-ray diffractometry, X-ray photoelectron spectrometry and Fourier-transform infrared reflectance, N-2-physiosorption, and activity measurements with CO, C3H6 and NO. The amount of accumulated phosphorus was higher on the Pt catalyst surface than on the PtPd catalyst and significantly higher on the surface of the bare support material. Phosphorus concentration was uniform throughout the support layer (down to the 10 μm), and phosphorus was found as phosphate, although it can also form compounds like AlPO(4) with the support. The treatment with low phosphorus concentration was found to have a clear deactivation effect only for C3H6 oxidation activity on PtPd catalysts above 200 degrees C. The treatment with high phosphorus concentration significantly decreased the activity of both the PtPd and Pt catalysts. In particular, the C3H6 and NO oxidation activities of the fresh and P-treated Pt catalysts were higher than those of the PtPd catalysts for the entire temperature range.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Materials Characterization, Univ Oulu, University of Oulu, Fac Technol, Environm & Chem Engn, Aalto University, Dinex Ecocat Oy, Catalyst Res
The Effect of Phosphorus Exposure on Diesel Oxidation Catalysts—Part II: Characterization of Structural Changes by Transmission Electron Microscopy

Phosphorus poisoning and its effect on the diesel oxidation catalysts morphology was studied by transmission electron microscopy (TEM). The studied catalyst samples were PtPd or Pt supported on the alumina-based washcoat including additives. The laboratory-scale phosphorus exposures were carried out with two different phosphorus concentrations. The cross-sectional TEM samples were prepared from the fresh and phosphorus-treated catalysts. After phosphorus exposures, significant structural changes were observed compared to the fresh catalysts. The shape of the noble metal particles had changed from irregular to more spherical-shaped particles. In addition, phosphorus was detected throughout the catalyst TEM samples but the amount varied depending on the local composition of the support. Phosphorus accumulated mainly in the alumina-containing areas of the support and indications of dense and amorphous aluminium phosphates were found. Based on the results gained, cross-sectional TEM characterization is essential to observe these kinds of morphological changes in the catalysts caused e.g. by phosphorus exposures. In addition, cross-sectional TEM samples are needed to study the effect of local variation in the support composition on the phosphorus accumulation.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Materials Characterization, Univ Oulu, University of Oulu, Fac Technol Mass & Heat Transfer Proc Engn, Aalto University, Dinex Ecocat Oy
Authors: Honkanen, M., Kärkkäinen, M., Heikkinen, O., Kallinen, K., Kolli, T., Huuhtanen, M., Lahtinen, J., Keiski, R. L., Lepistö, T., Vippola, M.
Coating of Silica and Titania Aerosol Nanoparticles by Silver Vapor Condensation

Silica and titania aerosol nanoparticles are coated with silver through a physical coating process. The silver is evaporated in a tubular furnace flow system and condensed on the ceramic carrier particles with diameters of approximately 100nm. The temperature gradient in the furnace system is optimized in order to avoid homogeneous nucleation of the silver. The generated ceramic-silver composite nanoparticles are characterized with aerosol measurements and analytical transmission electron microscopy. Two completely different particle morphologies are clearly observed, silver-decoration and composite doublet, with amorphous silica and crystalline rutile titania as the carrier particles, respectively. The former morphology consists of multiple silver nanodots with diameters of 1-10nm, while in the latter morphology the silver had formed a larger structure with a size comparable to that of the carrier particle. Different shapes are observed in these larger silver structures, such as triangular, rodlike, and hexagonal. Differences in the silver particle migration on the surface of the silica and titania particles is proposed to be the key factor resulting into the two distinct particle morphologies.

Coating of Silica and Titania Aerosol Nanoparticles by Silver Vapor Condensation

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Measuring synthesis yield in graphene oxide synthesis by modified hummers method

Synthesis of graphene oxide by the modified Hummers method and measuring the synthesis yield was investigated. Based on the results, a comprehensive method to measure graphene oxide synthesis yield was proposed, which will allow comparison of future literature results. In addition, changes are proposed to the exfoliation procedure to improve the yield of the modified Hummers synthesis. With the proposed method, systematic error of the concentration measurement was calculated to be \( \pm 0.08 \times 10^{-3} \) g mL\(^{-1}\). In addition, changes proposed to the graphene oxide exfoliation process can improve the synthesis yield by up to 70%.
Electrospun Black Titania Nanofibers: Influence of Hydrogen Plasma-Induced Disorder on the Electronic Structure and Photoelectrochemical Performance

This work encompasses a facile method for tailoring surface defects in electrospun TiO2 nanofibers by employing hydrogen plasma treatments. This amiable processing method was proven with SQUID, EPR, and XPS to be highly effective in generating oxygen vacancies, accompanied by the reduction of Ti4+ centers to Ti3+, resulting in the formation of black titania. The treatment temperature was found to affect the Ti3+/Ti4+ ratios and surface valence, while preserving the original 1D morphology of the titania fibers. Ab initio DFT calculations showed that a high concentration of oxygen vacancies is highly efficient in producing midgap states that enhance the system absorption over the whole visible range, as observed with UV/vis/NIR diffuse reflectance spectroscopy. Pristine TiO2 nanofibers produced a photocurrent density of similar to 0.02 mA/cm(2) at 1.23 V vs RHE, whereas the hydrogen plasma treatment resulted in up to a 10-fold increase in the photoelectrochemical performance.
Low temperature temporal and spatial atomic layer deposition of TiO2 films

Titanium dioxide films were grown by atomic layer deposition (ALD) using titanium tetraisopropoxide as a titanium precursor and water, ozone, or oxygen plasma as coreactants. Low temperatures (80-120 degrees C) were used to grow moisture barrier TiO2 films on polyethylene naphthalate. The maximum growth per cycle for water, ozone, and oxygen plasma processes were 0.33, 0.12, and 0.56 angstrom/cycle, respectively. X-ray photoelectron spectrometry was used to evaluate the chemical composition of the layers and the origin of the carbon contamination was studied by deconvoluting carbon C1s peaks. In plasma-assisted ALD, the film properties were dependent on the energy dose supplied by the plasma. TiO2 films were also successfully deposited by using a spatial ALD (SALD) system based on the results from the temporal ALD. Similar properties were measured compared to the temporal ALD deposited TiO2, but the deposition time could be reduced using SALD. The TiO2 films deposited by plasma-assisted ALD showed better moisture barrier properties than the layers deposited by thermal processes. Water vapor transmission rate values lower than 5 x 10(-4) g day(-1) m(-2) (38 degrees C and 90% RH) was measured for 20 nm of TiO2 film deposited by plasma-assisted ALD. (C) 2015 American Vacuum Society.
Dissolution of enzyme-treated cellulose using freezing thawing method and the properties of fibres regenerated from the solution

The rapid coagulation of NaOH-based cellulose solution during the wet spinning process leads to a low stretching ratio and, consequently, the low mechanical properties of the fibres. The aim of this work was to slow down the coagulation by replacing the sulphuric acid spin bath with an acetic acid bath. The spin dope was prepared by dissolving the enzyme-treated dissolving pulp in aqueous sodium zincate using a freezing thawing method. The optimal zinc oxide and sodium hydroxide concentrations were studied first. The most thermally stable cellulose solution contained 6.5 wt% NaOH and 1.3 wt% ZnO with 6 wt% enzyme-treated dissolving pulp. The spin dope was prepared accordingly. Coagulation of the cellulose solution slowed down in the acetic acid bath, resulting in a significantly higher stretching ratio for the fibres than with the sulphuric acid bath. However, the acetic acid spun fibres shrunk strongly during drying, and the possibly aligned order of the molecular chains due to the high stretch was partly lost. As a consequence, the high stretch was not transferred to high tenacity of the fibres in this study. However, the result suggests attractive potential to develop processing conditions to increase fibre tenacity.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Authors: Vehviläinen, M., Kamppuri, T., Gronqvist, S., Rissanen, M., Maloney, T., Honkanen, M., Nousiainen, P.
Number of pages: 22
Pages: 1653-1674
Publication date: Jun 2015
Peer-reviewed: Yes

Publication information
Journal: Cellulose
Volume: 22
Issue number: 3
ISSN (Print): 0969-0239
Ratings:
Scopus rating (2016): CiteScore 3.68 SJR 1.126 SNIP 1.144
Scopus rating (2015): SJR 1.153 SNIP 1.24 CiteScore 3.55
Scopus rating (2014): SJR 1.071 SNIP 1.334 CiteScore 3.58
Scopus rating (2013): SJR 1.127 SNIP 1.48 CiteScore 3.83
Scopus rating (2012): SJR 1.179 SNIP 1.71 CiteScore 3.74
Scopus rating (2011): SJR 1.354 SNIP 1.795 CiteScore 3.99
Scopus rating (2010): SJR 0.873 SNIP 1.384
Scopus rating (2009): SJR 1.038 SNIP 1.219
Scopus rating (2008): SJR 0.926 SNIP 1.123
Scopus rating (2007): SJR 0.754 SNIP 1.034
Scopus rating (2006): SJR 0.699 SNIP 1.15
Scopus rating (2005): SJR 1.112 SNIP 1.318
Scopus rating (2004): SJR 0.855 SNIP 1.072
Scopus rating (2003): SJR 0.81 SNIP 1.02
Scopus rating (2002): SJR 0.649 SNIP 0.689
Dissolution of wood pulp can be enhanced by applying certain pretreatments before exposing the fibers to solvents. We have analyzed the effect of mechanical and enzymatic pretreatments on softwood fiber wall structure using nuclear magnetic resonance (NMR) spectroscopic methods, small and wide angle X-ray scattering (SAXS, WAXS). NMR diffusometry was used to estimate the effect of pretreatments on average pore sizes at micrometer size scale and for the connectivity of the porous network. A proton NMR experiment was used to quantify the nonfreezing water content inside the fiber wall, and solid state NMR C-13 cross polarization (CP) magic angle spinning (MAS) spectroscopy was used to observe the effect of pretreatments on crystallinity and lateral fibril dimensions of cellulose fibrils, and in combination with fiber saturation point measurement to calculate the average pore size at nanometer size scale. Both WAXS and CP MAS NMR experiments confirmed that there were no changes in crystallinity nor in fibril lateral dimensions due to pretreatments. The pretreatments caused an increase in the amount of nonfreezing water, suggesting an opening of the pore system. According to diffusion experiments there are only minor changes in micrometer scale pore network due to pretreatments. SAXS results indicated that enzymatic treatment increased the microfibrillar distance, and there was also an increase in cross relaxation rate of magnetization from water to cellulose protons as observed by NMR. These were interpreted to be due to opening of microfibrillar bundles, leading to an increased accessibility of water.

Impact of mechanical and enzymatic pretreatments on softwood pulp fiber wall structure studied with NMR spectroscopy and X-ray scattering

Dissolution of wood pulp can be enhanced by applying certain pretreatments before exposing the fibers to solvents. We have analyzed the effect of mechanical and enzymatic pretreatments on softwood fiber wall structure using nuclear magnetic resonance (NMR) spectroscopic methods, small and wide angle X-ray scattering (SAXS, WAXS). NMR diffusometry was used to estimate the effect of pretreatments on average pore sizes at micrometer size scale and for the connectivity of the porous network. A proton NMR experiment was used to quantify the nonfreezing water content inside the fiber wall, and solid state NMR C-13 cross polarization (CP) magic angle spinning (MAS) spectroscopy was used to observe the effect of pretreatments on crystallinity and lateral fibril dimensions of cellulose fibrils, and in combination with fiber saturation point measurement to calculate the average pore size at nanometer size scale. Both WAXS and CP MAS NMR experiments confirmed that there were no changes in crystallinity nor in fibril lateral dimensions due to pretreatments. The pretreatments caused an increase in the amount of nonfreezing water, suggesting an opening of the pore system. According to diffusion experiments there are only minor changes in micrometer scale pore network due to pretreatments. SAXS results indicated that enzymatic treatment increased the microfibrillar distance, and there was also an increase in cross relaxation rate of magnetization from water to cellulose protons as observed by NMR. These were interpreted to be due to opening of microfibrillar bundles, leading to an increased accessibility of water.
High temperature oxidation tests for the high velocity solution precursor flame sprayed manganese-cobalt oxide spinel protective coatings on SOFC interconnector steel

High velocity solution precursor flame spray process was used to deposit MnCo1.9Fe0.1O4 and Mn1.5Co1.5O4 coatings on Crofer 22 APU ferritic stainless steel samples. The solution precursors were manufactured by diluting metal nitrates into deionized water. The as-sprayed coatings were oxidized at 850 degrees C for 500 h to evaluate Cr-barrier and electrical properties.

The post-mortem studies were performed with various qualitative and quantitative elemental analysis methods and a four-point measurement was used for the area specific resistance studies. The as-sprayed coatings were formed of single crystallite nanoparticles (10-20 nm) and polycrystalline sub-micron particles (100-500 nm). The small particle and crystallite size showed strong sintering behavior during the oxidation cycle. Cr-migration was fully prevented thought the oxidized coatings. The surface topography and grain growth dominated the electrical properties during the test cycle. Copyright (C) 2015, Hydrogen Energy Publications, LLC. Published by Elsevier Ltd. All rights reserved.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Surface Engineering, Research group: Materials Characterization, Research group: Ceramic materials, Engineering materials science and solutions (EMASS), Univ Toronto, University of Toronto, Dept Mat Sci & Engn, Univ Toronto, University of Toronto, Dept Mech & Ind Engn
Authors: Puranen, J., Laakso, J., Honkanen, M., Heinonen, S., Kylmälahti, M., Lugowski, S., Coyle, T. W., Kesler, O., Vuoristo, P.
Number of pages: 12
Pages: 6216-6227
Publication date: 18 May 2015
Peer-reviewed: Yes

Publication information
Volume: 40
Issue number: 18
ISSN (Print): 0360-3199
Ratings:
Scopus rating (2016): SJR 1.142 SNIP 1.286 CiteScore 3.74
Scopus rating (2015): SJR 1.294 SNIP 1.319 CiteScore 3.46
Scopus rating (2014): SJR 1.212 SNIP 1.494 CiteScore 3.54
Scopus rating (2013): SJR 1.278 SNIP 1.467 CiteScore 3.38
Scopus rating (2012): SJR 1.515 SNIP 1.729 CiteScore 3.96
Scopus rating (2011): SJR 1.456 SNIP 1.837 CiteScore 4.42
Scopus rating (2010): SJR 1.589 SNIP 1.871
Scopus rating (2009): SJR 1.333 SNIP 1.885
Scopus rating (2008): SJR 1.401 SNIP 2.096
Scopus rating (2007): SJR 1.279 SNIP 2.201
Preferential Attachments of Organic Dyes onto {101} Facets of TiO2 Nanoparticles

Hybrid nanostructures of organic dyes/TiO2 nanoparticles were successfully fabricated by self-assembly method. Compared with pure organic dyes, these hybrid nanostructures showed enhanced performance of belt absorption. Extensive high-resolution transmission electron Microscopy observations demonstrated that the organic dyes are preferentially attached onto the {101} facets of anatase TiO2 nanoparticles. Density functional theory calculations further confirmed that the preferential attachments are reasonable. These discoveries are very important.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research group: Supramolecular photochemistry, Department of Chemistry and Bioengineering, Frontier Photonics, Qingdao Univ, Qingdao University, Cultivat Base State Key Lab, Qingdao Univ, Qingdao University, Coll Chem Sci & Engr, Qingdao Univ, Qingdao University, Coll Phys, Qingdao Univ, Qingdao University, Shandong University, Shandong Univ, Key Lab Photon Mat & Technol
Authors: Diao, F., Liang, W., Tian, F., Wang, Y., Vivo, P., Efimov, A., Lemmetyinen, H.
Number of pages: 6
Pages: 8960-8965
Publication date: 23 Apr 2015
Peer-reviewed: Yes

Publication information
Journal: Journal of Physical Chemistry C
Volume: 119
Issue number: 16
ISSN (Print): 1932-7447
Ratings:
Scopus rating (2016): SJR 1.948 SNIP 1.181 CiteScore 4.48
Scopus rating (2015): SJR 1.917 SNIP 1.268 CiteScore 4.68
Scopus rating (2014): SJR 2.027 SNIP 1.448 CiteScore 5.08
Scopus rating (2013): SJR 2.134 SNIP 1.439 CiteScore 5.14
Scopus rating (2012): SJR 2.514 SNIP 1.46 CiteScore 4.98
Scopus rating (2011): SJR 2.32 SNIP 1.457 CiteScore 4.92
Scopus rating (2010): SJR 2.438 SNIP 1.356
Scopus rating (2009): SJR 2.128 SNIP 1.417
Scopus rating (2008): SJR 1.856 SNIP 1.033
Original language: English
Keywords: SENSITIZED SOLAR-CELLS, ANATASE, SURFACES, ADSORPTION, WATER, OXIDE
DOIs:
10.1021/acs.jpcc.5b01369
Links:
http://www.scopus.com/inward/record.url?scp=84928527015&partnerID=8YFLogxK (Link to publication in Scopus)
Source: WOS
Source-ID: 000353603500062
Research output: Scientific - peer-review › Article
Fermentative metabolism of an anaerobic, thermophilic consortium on plant polymers and commercial paper samples

The purpose of the study was to examine the feasibility and capacity of a thermophilic microbial consortium to produce fermentative metabolites from plant polymers. The consortium comprised of cellulolytic anaerobes that were originally enriched from a compost pile using cellulose as the substrate. Fermentative metabolism was examined with monosaccharides, disaccharides, hemicellulose, starch, pectin, chitin, and eight commercial paper samples without further enrichment of the culture to each specific substrate. In general, H₂, CH₄, CO₂, and organic acids were the main metabolites on all substrates but the metabolite profiles varied with the substrate. Similar H₂ yields of 2-3 mol mol⁻¹ substrate at 48h were obtained with all monosaccharides and disaccharides. The CO₂ yields were higher with disaccharides than with monosaccharides, 4.5 vs 2 mol mol⁻¹ substrate. Metabolite yields were relatively low with glyceraldehyde, glycerol, and arabinose. Paper samples containing high amounts of chemical pulp produced the highest metabolite yields, and biodegradation accounted for ≤74% of total dry weight loss. The fermentative metabolism of the paper samples varied with the pulp composition and the amount of inorganic material. Bacterial community analysis using pyrosequencing analysis of 16S rRNA gene showed a predominance of members of the order Clostridiales, including members of genera Clostridium and Lutispora, which contain known cellulolytic organisms. Most differences among the samples were attributed to small taxonomic groups represented by ≤10% of total sequences.
Effect of rheological properties of dissolved cellulose/microfibrillated cellulose blend suspensions on film forming

Enzymatically treated cellulose was dissolved in a NaOH/ZnO solvent system and mixed together with microfibrillated cellulose (MFC) in order to find the threshold in which MFC fibers form a percolation network within the dissolved cellulose solution and in order to improve the properties of regenerated cellulose films. In the aqueous state, correlations between the rheological properties of dissolved cellulose/MFC blend suspensions and MFC fiber concentrations were investigated and rationalized. In addition, rheological properties of diluted MFC suspensions were characterized and a correlation with NaOH concentration was found, thus partly explaining the flow properties of dissolved cellulose/MFC blend suspensions. Finally, based on results from Dynamic Mechanical Analysis (DMA), MFC addition had strengthening/plasticizing effect on regenerated cellulose films if low concentrations of MFC, below the percolation threshold (5.5-6 wt%, corresponding to 0.16-0.18 wt% of MFC in the blend suspensions), were used.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Fibre Materials, PolymerTechnology, Department of Biotechnology and Chemical Technology, Aalto University
Authors: Saarikoski, E., Rissanen, M., Seppälä, J.
Number of pages: 9
Pages: 62-70
Publication date: 30 Mar 2015
Peer-reviewed: Yes

Publication information
Journal: Carbohydrate Polymers
Volume: 119
ISSN (Print): 0144-8617
Ratings:
Scopus rating (2016): SJR 1.404 SNIP 1.745 CiteScore 5.15
Scopus rating (2015): SJR 1.46 SNIP 1.842 CiteScore 4.86
Scopus rating (2014): SJR 1.584 SNIP 1.969 CiteScore 4.69
Scopus rating (2013): SJR 1.346 SNIP 1.967 CiteScore 4.39
Scopus rating (2012): SJR 1.409 SNIP 2.045 CiteScore 3.93
Scopus rating (2011): SJR 1.287 SNIP 1.991 CiteScore 4.08
Scopus rating (2010): SJR 1.372 SNIP 1.808
Scopus rating (2009): SJR 1.43 SNIP 1.718
Scopus rating (2008): SJR 1.142 SNIP 1.515
Scopus rating (2007): SJR 0.879 SNIP 1.369
Scopus rating (2006): SJR 0.824 SNIP 1.424
Scopus rating (2005): SJR 0.816 SNIP 1.349
Scopus rating (2004): SJR 0.885 SNIP 1.538
Scopus rating (2003): SJR 0.937 SNIP 1.41
Scopus rating (2002): SJR 0.878 SNIP 1.372
Scopus rating (2001): SJR 0.828 SNIP 1.062
Scopus rating (2000): SJR 0.858 SNIP 1.086
Scopus rating (1999): SJR 0.764 SNIP 1.074
Original language: English
ASJC Scopus subject areas: Organic Chemistry, Materials Chemistry, Polymers and Plastics
Keywords: Blend, Dissolved cellulose, Microfibrillated cellulose, Rheology, Suspension
DOIs:
10.1016/j.carbpol.2014.11.033
Links:
http://www.scopus.com/inward/record.uri?scp=84916613635&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84916613635
Research output: Scientific › peer-review › Article

Modeling Fume Particle Dynamics and Deposition with Alkali Metal Chemistry in Kraft Recovery Boilers

The kraft recovery boiler is the largest single unit in the pulp-making process, which makes its reliable operation important. However, the fuel of the recovery boiler, black liquor, contains large quantities of ash-forming elements that pose challenges to the efficient operation of the boiler. A fraction of these elements vaporizes in the recovery boiler and
condenses to form submicron-sized particles, called fume. The fume particles may form fouling deposits on the heat transfer surfaces, cause plugging of the flue gas channels, and even expose the surfaces to corrosion. These problems often lead to unscheduled shutdowns of the boiler, which are expensive due to the large size of the modern pulp mills. Significant savings could be achieved if the behavior of the ash-forming elements could be better predicted. The objective of this thesis is to develop a CFD-based (computational fluid dynamics) model for the alkali metal chemistry, fume particles, and fume deposits in the kraft recovery boiler, and to use the model to simulate real recovery boilers. The model combines 3-dimensional CFD, fine particle dynamics, and equilibrium chemistry in a novel way, and solves the fume particle and deposit composition at different locations in the superheater area of the boiler. The model contains certain limitations, such as the steady-state approximation because a compromise has to be made between accuracy and computational cost, which is a significant factor when developing tools for industrial use. The model has been partially validated with measurements in an operating recovery boiler, and the modeling results are in good qualitative agreement with the measurements. Furthermore, the modeling results suggest that deposition through thermophoresis is the main mechanism of fume deposit formation in a recovery boiler, but also that the direct condensation of alkali chloride vapors to heat transfer surfaces can be significant if the black liquor chlorine content is high. According to the model sensitivity analysis, fume deposit growth seems to be a self-limiting process, since an increase in the deposit thickness lowers the rate of deposition by thermophoresis. Another important result is that chlorine enriches in the deposit layers closer to the tube surfaces, which is a result of the high temperature dependence of alkali chloride condensation. The CFD-based model developed here improves understanding of the fume formation mechanisms, shedding light on processes that would be difficult to investigate through experimental methods alone in the corrosive boiler environment. In particular, the model can simulate how certain operational changes, such as increasing boiler load or steam temperatures, affect the alkali metal and fume behavior. In the future, the model can be utilized in the industry to support the engineering of new recovery boilers, and minimize fouling, plugging, and corrosion problems.

**General information**

State: Published  
Ministry of Education publication type: G5 Doctoral dissertation (article)  
Organisations: Department of Chemistry and Bioengineering, Research group: Power Plant and Combustion Technology  
Authors: Leppänen, A.  
Number of pages: 63  
Publication date: 9 Jan 2015

**Publication information**

Place of publication: Tampere  
Publisher: Tampere University of Technology  
Volume: 1273  
Original language: English

**Publication series**

Name: Tampere University of Technology. Publication  
Publisher: Tampere University of Technology  
Volume: 1273  
ISSN (Print): 1459-2045  
Electronic versions:  
leppanen_1273  
Links:  

**Bibliographical note**

Awarding institution:Tampereen teknillinen yliopisto - Tampere University of Technology<br/>Submitter: Submitted by Aino Leppänen (aino.leppanen@tut.fi) on 2014-12-04T11:42:09Z  
No. of bitstreams: 1  
leppanen.pdf: 11632435 bytes, checksum: 39df920dc3d950e8daff235226bab20c (MD5)  
Submitter: Approved for entry into archive by Kaisa Kulkki (kaisa.kulkki@tut.fi) on 2014-12-12T10:41:51Z (GMT)  
No. of bitstreams: 1  
leppanen.pdf: 11632435 bytes, checksum: 39df920dc3d950e8daff235226bab20c (MD5)  
Submitter: Made available in DSpace on 2014-12-12T10:41:51Z (GMT)  
No. of bitstreams: 1  
leppanen.pdf: 11632435 bytes, checksum: 39df920dc3d950e8daff235226bab20c (MD5)  
Source: researchoutputwizard  
Source-ID: 123456789/22675  
Research output: Collection of articles › Doctoral Thesis

**Perfluoro-1,1′-biphenyl and perfluoronaphthalene and their derivatives as π-acceptors for anions**

Addition of anions to perfluorinated 1,1′-biphenyl 1 or naphthalene 2 results in a shift of the 19F NMR signals. However, any specific interaction cannot be assigned to this effect. In order to study the interaction in more detail, the salt derivatives 3 and 4 were prepared and studied by single crystal X-ray diffraction revealing weak anion-π interactions in the
In the field of surface engineering, cladding or overlay welding is a group of coating methods used in manufacturing fusion-bonded thick metallic and metal matrix composite (MMC) coatings on a wide variety of metallic base materials with varying degree of deposition rate, dilution and heat input. Growing demands for more material-, energy- and cost-effective overlay welding processes as well as sustainable solutions for performance-critical applications have boosted to develop methods that are capable of producing low diluted and fusion-bonded single layer coatings with high deposition rates. Such novel cladding methods include for instance laser-based high power laser cladding, coaxial hot-wire laser cladding, laser-arc hybrid cladding, non-laser-based Cold Metal Transfer (CMT) cladding and methods that utilize high intensity infrared (IR) light. This paper introduces some of such highly innovative cladding techniques and highlights some microstructural and geometrical features, abrasion and sliding wear, and wet corrosion properties of Fe-, Ni- and Co-based metallic coatings manufactured by novel laser and CMT cladding methods. The research results evidence that with the choice of optimal processing parameters, novel cladding techniques are capable of manufacturing high performance weld overlays with the properties equivalent or near to corresponding wrought alloys and reference overlays with net deposition rates of approximately 5 kg/h and more. Overall, the presented work suggests that discussed methods have high potential in surfacing of new and remanufacturing of service-damaged surfaces in high value components, in building solid state.
up complex features on existing components and also in near net shape additive manufacturing of functional 3D objects.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Surface Engineering, Research group: Materials Characterization, Department of Mechanical Engineering and Industrial Systems, Research area: Manufacturing and Automation, Technology Centre Ketek Ltd.
Authors: Tuominen, J., Näkki, J., Pajukoski, H., Nyyssönen, T., Ristonen, T., Peltola, T., Vuoristo, P.
Number of pages: 13
Pages: 105-117
Publication date: Jan 2015

Host publication information
Title of host publication: Surface Modification Technologies XXVIII : Proceedings of the 28th International Conference on Surface Modification Technologies
Publisher: Valardocs
Editors: Sudarshan, T., Vuoristo, P., Koivuluoto, H.
ISBN (Electronic): 978-81-926196-1-3
Keywords: Cladding, Additive manufacturing, Laser, CMT, Metallien 3D-tulostus, 3D printing, Remanufacturing, Uudelleenvalmistus, Digital manufacturing, Digitaalinen valmistus

Bibliographical note
xoa ei tarkistettu

Research output: Scientific - peer-review › Conference contribution

Corrosion propagation phase studies on Finnish reinforced concrete facades

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Civil Engineering, Research group: Service Life Engineering of Structures, Department of Materials Science, Research group: Materials Characterization
Authors: Köliö, A., Honkanen, M., Lahdensivu, J.
Publication date: 2015

Host publication information
Title of host publication: 1st International Symposium on Building Pathology : ISBP 2015
Place of publication: Porto
Publisher: FEUP Edicoes (Faculdade de Engenharia da Universidade do Porto Edicoes)
ISBN (Print): 978-972-752-174-6

Bibliographical note
ORG=rak,0.5
ORG=mol,0.5
Research output: Scientific - peer-review › Conference contribution

Diffusion of acidic solution through rubber at high temperature and its effect on metal-rubber interface degradation

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Teknikum Oy, Outotec Research Center
Authors: Sarlin, E., Rosling, A., Mustakangas, M., Laihonen, P., Lindgren, M., Vuorinen, J.
Publication date: 2015

Host publication information
Title of host publication: Proceedings of SAMPE Europe Conference
ISBN (Electronic): 978-90-821727-3-7
Research output: Scientific › Conference contribution
Effect of alkali and silane surface treatments on regenerated cellulose fibre type (Lyocell) intended for composites

Cellulose fibres have significant importance and potential for polymer reinforcement. It is essential to modify the surface of the fibre to obtain good fibre-matrix interface. Surface treatments can increase surface roughness of the fibre, change its chemical composition and introduce new moieties that can effectively interlock with the matrix, resulting in good mechanical properties in the composites. This is mainly due to improved fibre-matrix adhesion. The treatments may also reduce the water absorption rate by converting part of the hydroxyl groups on the fibre surface into other functional groups. Chemical modification of the surface of a regenerated cellulose fibre of the Lyocell type was carried out by alkali and silane treatments, which significantly changed the properties of the Lyocell fibres. Three parameters were considered when the fibre surface treatment was done: concentration (2–15 wt%), temperature (25 and 50 °C) and time (30 min–72 h). Fourier transform infrared spectroscopy and Raman spectroscopy were used for chemical analysis and qualitative analysis of the cellulose crystallinity due to the surface treatments; subsequently, mechanical strength of the fibres was tested by tensile testing. Weight loss, moisture regain and swelling measurements were taken before and after treatments, which showed the obvious changes in fibre properties on treatment. Heat capacity of the fibres was measured for untreated and treated fibres, and thermal degradation of fibres was examined to see the stability of fibres at elevated temperatures. Wettability and surface energies were measured using dynamic contact angle method in three wetting mediums. Scanning electron microscopy was used to study the morphological properties of the fibres.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Fibre Materials, University College of Borås, Högskolan i Borås, Swedish Centre for Resource Recovery
Authors: Ramamoorthy, S. K., Skrifvars, M., Rissanen, M.
Number of pages: 18
Pages: 637-654
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Cellulose
Volume: 22
Issue number: 1
ISSN (Print): 0969-0239
Ratings:
Scopus rating (2016): CiteScore 3.68 SJR 1.126 SNIP 1.144
Scopus rating (2015): SJR 1.153 SNIP 1.24 CiteScore 3.55
Scopus rating (2014): SJR 1.071 SNIP 1.334 CiteScore 3.58
Scopus rating (2013): SJR 1.127 SNIP 1.48 CiteScore 3.83
Scopus rating (2012): SJR 1.179 SNIP 1.71 CiteScore 3.74
Scopus rating (2011): SJR 1.354 SNIP 1.795 CiteScore 3.99
Scopus rating (2010): SJR 0.873 SNIP 1.384
Scopus rating (2009): SJR 1.038 SNIP 1.219
Scopus rating (2008): SJR 0.926 SNIP 1.123
Scopus rating (2007): SJR 0.754 SNIP 1.034
Scopus rating (2006): SJR 0.699 SNIP 1.15
Scopus rating (2005): SJR 1.112 SNIP 1.318
Scopus rating (2004): SJR 0.855 SNIP 1.072
Scopus rating (2003): SJR 0.81 SNIP 1.02
Scopus rating (2002): SJR 0.649 SNIP 0.689
Scopus rating (2001): SJR 0.602 SNIP 0.785
Scopus rating (2000): SJR 0.583 SNIP 0.773
Scopus rating (1999): SJR 0.67 SNIP 1.14
Original language: English
ASJC Scopus subject areas: Polymers and Plastics
Keywords: Alkali, Cellulose, Fibre, Lyocell, Silane, Surface modification
DOIs:
10.1007/s10570-014-0526-6
Links:
http://www.scopus.com/inward/record.url?scp=84921943065&partnerID=8YFLogxK (Link to publication in Scopus)
High-temperature slurry erosion of vinylester matrix composites – The effect of test parameters

Glass fibre (GF) reinforced vinylester composites (VE-FRP) are commonly used materials in hydrometallurgical reactors, the pulp and paper industry and waste water treatment plants, due to their excellent chemical resistance combined with good mechanical performance. In these applications, materials can be subjected to erosion, elevated temperatures (as high as 95 °C) and various chemical environments. However, studies on the slurry erosion of vinylester-based composites at high temperatures have not yet been reported. In this study, the erosion resistance of GF reinforced VE-FRP was investigated with a pilot-scale reactor. The effect of slurry concentration, erodent particle kinetic energy and slurry temperature was studied. The dominating wear mechanism was found to be abrasive wear. The VE-FRP structure was found to be prone to erosive turbulent flow and cavitation. Moreover, an increase in the erodent concentration of the slurry (10-20. wt%) or in the total kinetic energy of the erodent particles (30-770. kJ) increased the wear rate of the material markedly (up to 6 times higher weight loss). However, the total effect of different interrelated parameters was found to be complex. Consequently, it is recommended that predictions of the erosion rate of VE-FRP components are based on tests carried out in conditions that simulate the actual service environment.
N-Alkyl ammonium resorcinarene salts: multivalent halogen-bonded deep-cavity cavitands

N-Cyclohexyl ammonium resorcinarene halides, stabilized by an intricate array of hydrogen bonds in a cavitand-like assembly, form multivalent halogen-bonded deep-cavity cavitands with perfluoriodobenzenes. As observed from the macromolar to infinite concentration range through crystal growth and single crystal X-ray analyses, four 1,4-diodotetrafluorobenzenes form moderate halogen bonds with the bromides of the N-cyclohexyl ammonium resorcinarene bromides leading to a deep-cavity cavitand-like structure. In this assembly, the N-cyclohexyl ammonium resorcinarene bromide also acts as a guest and sits in the upper cavity of the assembly interacting with the 1,4-diodotetrafluorobenzene through strong pi center dot center dot center dot pi interactions. Solvent molecules act as guests and are located deep in the cavity of the resorcinarene skeleton. In the millimolar range, H-1 and F-19 NMR spectroscopic analyses confirm halogen bonding in solution. Fast exchange binding of electron rich fluorophores (naphthalene, anthracene and pyrene) in the upper layer of these assemblies was also observed in the millimolar range while in the micromolar range, using fluorescence analysis, no binding of the fluorophores was observed.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Chemistry and Bioengineering, Univ Jyvaskyla, University of Jyvaskyla, Dept Chem, Nanosci Ctr
Authors: Beyeh, N. K., Valkonen, A., Bhowmik, S., Pan, F., Rissanen, K.
Number of pages: 6
Pages: 340-345
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Organic chemistry frontiers
Volume: 2
Issue number: 4
ISSN (Print): 2052-4129
Ratings:
Scopus rating (2016): SJR 2.33 SNIP 0.835 CiteScore 4.72
Scopus rating (2015): SJR 2.34 SNIP 0.886 CiteScore 4.51
Research on icing behavior and ice adhesion testing of icephobic surfaces

Surface engineering shows potential to provide sustainable approach to icing problems. Currently several passive anti-ice mechanisms adoptable to coatings are known but further research is required to proceed for practical applications. Icing wind tunnel and centrifugal ice adhesion test equipment enable the evaluation and development of anti-ice and icephobic coatings for e.g., wind turbine applications but also other growing players in arctic environment e.g. oil, extractive and logistic industries. This research is focused on the evaluation of icing properties of various surfaces.

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Materials Science, Research group: Surface Engineering
Authors: Koivuluoto, H., Stenroos, C., Ruohomaa, R., Bolelli, G., Lusvarghi, L., Vuoristo, P.
Number of pages: 6
Pages: 183-188
Publication date: 2015

Host publication information
Title of host publication: 16th International Workshop on Atmospheric Icing of Structures, IWAIS 2015, June 28-July 3, 2015, Uppsala, Sweden
Links:
http://iwais.org/

Simulation of ash-forming compounds in the kraft recovery boiler
This paper presents a summary of the doctoral dissertation titled "Modeling Fume Particle Dynamics and Deposition with Alkali Metal Chemistry in Kraft Recovery Boilers". In the thesis, a computational model was developed and used to simulate the behavior of alkali metal compounds in kraft recovery boilers. The model combines, for the first time, the methods of CFD (Computational Fluid Dynamics), equilibrium chemistry, and fine particle dynamics to model the formation and deposition of fume particles. Fume particles are below 1 μm in diameter and form through the condensation of the alkali metal compounds. The model has been partially validated in an operating recovery boiler in terms of fume particle composition, but the modeling results also shed light on processes that cannot be investigated through experimental methods alone. For example, the modeling results indicate that thermophoresis is the main factor leading to fume deposit formation.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Chemistry and Bioengineering, Research group: Power Plant and Combustion Technology
Authors: Leppänen, A., Välimäki, E., Oksanen, A.
Number of pages: 10
Publication date: 2015

Host publication information
Title of host publication: 10th European Conference on Industrial Furnaces and Boilers
Place of publication: Porto, Portugal
ISBN (Electronic): 978-972-99309-7-3
Keywords: kraft recovery boiler, alkali metal, fine particle, deposition, computational fluid dynamics
Links:
http://www.ceneretc.pt/infub/
Source: Bibtex
Source-ID: urn:c8809f51c0b1f0404f1a0f11bb345f
Research output: Scientific - peer-review › Conference contribution
Synthesis, crystal structure, spectral, dielectric characteristics and conduction mechanism of two novel carboxylates of 1-benzhydrylpiperazine

Two new 1-benzhydrylpiperazinium carboxylates with tartrate and maleate, (C17H21N2)(C4H5O6) and (C17H22N2)(C4H3O4)2, have been synthesized and characterized. Crystal structure determinations show that the compounds crystallize in the P21 and the P21/c space groups of the monoclinic system, respectively. Only in the maleate the organic group is protonated on both nitrogen atoms of piperazine ring. The infrared spectra of these compounds reported from 400 to 4000 cm−1 confirmed the presence of the principal bands assigned to the internal modes of cations and anions of both compounds. The optical band gaps were calculated and found to be 3.46 and 4.14 eV for tartrate and maleate, respectively. Different molecular motions were determinate via dielectric relaxation spectroscopy. Measurements of AC conductivity as a function of frequency at different temperatures indicated the hopping conduction mechanism. The number of 13C CP-MAS NMR lines is in good agreement with the crystallographic data. Graphical abstract: [Figure not available: see fulltext.]

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Chemistry and Bioengineering, Laboratory of Chemical Materials, Faculty of Sciences of Bizerte, Carthage University
Authors: Wacharine, I., Valkonen, A., Rzaigui, M., Smirani, W.
Number of pages: 14
Pages: 2007-2020
Publication date: 2015
Peer-reviewed: Yes

Publication Information
Journal: Monatshefte fur Chemie
Volume: 146
Issue number: 12
ISSN (Print): 0026-9247
Ratings:
Scopus rating (2016): SJR 0.338 SNIP 0.536 CiteScore 1.22
Scopus rating (2015): SJR 0.331 SNIP 0.559 CiteScore 1.15
Scopus rating (2014): SJR 0.358 SNIP 0.603 CiteScore 1.26
Scopus rating (2013): SJR 0.401 SNIP 0.71 CiteScore 1.45
Scopus rating (2012): SJR 0.533 SNIP 0.863 CiteScore 1.66
Scopus rating (2011): SJR 0.483 SNIP 0.753 CiteScore 1.52
Scopus rating (2010): SJR 0.471 SNIP 0.68
Scopus rating (2009): SJR 0.47 SNIP 0.64
Scopus rating (2008): SJR 0.451 SNIP 0.686
Scopus rating (2007): SJR 0.402 SNIP 0.58
Scopus rating (2006): SJR 0.44 SNIP 0.672
Scopus rating (2005): SJR 0.405 SNIP 0.673
Scopus rating (2004): SJR 0.422 SNIP 0.812
Scopus rating (2003): SJR 0.391 SNIP 0.63
Scopus rating (2002): SJR 0.495 SNIP 0.794
Scopus rating (2001): SJR 0.46 SNIP 0.734
Scopus rating (2000): SJR 0.419 SNIP 0.814
Scopus rating (1999): SJR 0.396 SNIP 0.66
Original language: English
Keywords: Carboxylic acids, Crystal structure, Hydrogen bonds, NMR spectroscopy, Solid state, X-ray structure determination
ASJC Scopus subject areas: Chemistry(all)
DOIs:
10.1007/s00706-015-1553-1
Links:
http://www.scopus.com/inward/record.url?scp=84939509914&partnerID=8YFLLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84939509914
Research output: Scientific - peer-review › Article
The effect of physical adhesion promotion treatments on interfacial adhesion in cellulose-epoxy composite

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Research group: Paper Converting and Packaging
Number of pages: 10
Publication date: 2015

Host publication information
Title of host publication: Proceedings of the 20th International Conference on Composite Materials
Links:
http://iccm20.org/fullpapers/file?f=WM39KAy5r2

Bibliographical note
ISBN- tai ISSN-numeroa kysytty, ei löydy
Research output: Professional › Conference contribution

The effect of the outermost fibre layers on solubility of dissolving grade pulp
Dissolving pulps are used to manufacture various cellulose derived products through cellulose dissolution. Solubility of cellulose pulp has been claimed to be strongly dependent on the porosity development, the degree of polymerisation and the pulp viscosity. The removal of external cell walls has been proposed to have a key role in the pulp solubility. In this paper, the effect of the outermost surface layers on the solubility of a dissolving grade pulp was studied. Furthermore the effect of mechanical peeling and combined mechanical and enzymatic treatment on pulp solubility was compared. Based on the results combined mechanical and enzymatic treatment efficiently opens up the fibre structure and has a clear positive effect on the solubility of dissolving pulp. It seems that long fibre fraction is less accessible to solvent chemicals than the other pulp fractions. Mechanical peeling of outer fibre layers does not improve fibre dissolution to NaOH/ZnO. Thus, it seems that peeling alone is not a sufficient pre-treatment prior to dissolution. The results also revealed that the peeling treatment does not enhance the effects of enzymes as the studied mechanical treatment does.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Fibre Materials, Department of Forest Products Technology, VTT Technical Research Centre of Finland, Latvian State Institute of Wood Chemistry, Aalto University
Authors: Grönqvist, S., Treimanis, A., Kamppuri, T., Maloney, T., Skute, M., Grinfelds, U., Vehviläinen, M., Suurnäkki, A.
Number of pages: 11
Pages: 3955-3965
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Cellulose
Volume: 22
Issue number: 6
ISSN (Print): 0969-0239
Ratings:
Scopus rating (2016): CiteScore 3.68 SJR 1.126 SNIP 1.144
Scopus rating (2015): SJR 1.153 SNIP 1.24 CiteScore 3.55
Scopus rating (2014): SJR 1.071 SNIP 1.334 CiteScore 3.58
Scopus rating (2013): SJR 1.127 SNIP 1.48 CiteScore 3.83
Scopus rating (2012): SJR 1.179 SNIP 1.71 CiteScore 3.74
Scopus rating (2011): SJR 1.354 SNIP 1.795 CiteScore 3.99
Scopus rating (2010): SJR 0.873 SNIP 1.384
Scopus rating (2009): SJR 1.038 SNIP 1.219
Scopus rating (2008): SJR 0.926 SNIP 1.123
Scopus rating (2007): SJR 0.754 SNIP 1.034
Scopus rating (2006): SJR 0.699 SNIP 1.15
Scopus rating (2005): SJR 1.112 SNIP 1.318
Scopus rating (2004): SJR 0.855 SNIP 1.072
Numerical modeling of fine particle and deposit formation in a recovery boiler

In kraft pulp mills, black liquor is concentrated and burned in recovery boilers to produce steam and power and to recover pulping chemicals. Black liquor contains a large amount of alkali compounds, which form ash with low melting temperatures upon combustion. This causes many problems in recovery boiler operation, including fouling of the heat transfer surfaces, plugging of the flue gas passages, reduction of the heat transfer rate, and corrosion of the superheater tubes. This paper presents a model for simulating fine fume particles formed as a result of condensation of alkali compound vapors in the recovery boiler. The modeling method combines CFD modeling, equilibrium chemistry, and fine particle dynamics in a way that enables simulation of a full scale three-dimensional boiler environment. The model has been partially validated with measurements performed in an operating recovery boiler. The modeling results, particularly for the fume particle composition, agree well with the actual measurements. (C) 2014 Elsevier Ltd. All rights reserved.
Design driven world of cellulose-from bulk to luxury?

Tektos—the Finnish Funding Agency for Innovation has granted funding 4.5 million funding for a project targeting on new approaches for use of wood-based cellulose. Project "Design Driven Value Chains in The World of Cellulose" (DWoC) launched by VTT Technical Research Centre of Finland, Aalto University and Tampere University of Technology integrates design and design processes into the strategic development of businesses operating in the field. The aim is to create a business ecosystem to serve both existing industry and a new, growing cellulose-based industry, and to brand Finland as a producer of refined, cellulose-based products. This manuscript summarises the future visions and background aspects and facts that have led to the initiation of the project. The presentation based on the manuscript also presents some of the first demonstrator processes and products developed during the first operational year of the project. These demonstrators include: Fibre yarn process that produces yarn from cellulose pulp fibres without traditional spinning process using novel wet extrusion technique (figure on right). Foam forming method for manufacturing well-formed foamed structures for new product applications 3D-printing technology enabling customisable on demand production of fibre structures and components using modified cellulose raw materials.
Modelling fume deposit growth in recovery boilers: effect of flue gas and deposit temperature

The high ash content of black liquor causes fouling problems in the Kraft recovery boiler. The ash-forming elements condense into submicron-sized fume particles in the superheater area and the boiler bank and can deposit on heat-transfer surfaces. The fume deposits can then lower heat-transfer rate, plug flue gas flow, and expose surfaces to corrosion. This paper presents the results of a sensitivity analysis obtained using a CFD (computational fluid dynamics)-based sub-model of the formation of fume particles and deposits, showing how flue gas and deposit surface temperatures affect instantaneous fume deposit growth. The results indicate that fume deposit growth is a self-limiting process because the growth rate decreases as the deposit surface temperature increases. On the other hand, increasing the flue gas temperature increases the fume deposition rate when the element release factors are kept constant.
The effects of UV irradiation to polyetheretherketone fibres: Characterization by different techniques

The effects of UV irradiation on polyetheretherketone (PEEK) fibres were investigated in this study. PEEK fibres were manufactured with a melt spinning system and then artificially aged with simulated solar UV light. Fibres were then characterized by mechanical tests, Fourier transform infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), rheology, thermogravimetric analysis (TGA) and scanning electron microscopy (SEM). PEEK, best known for its excellent thermal stability, suffered greatly from the effects of UV irradiation. The low UV stability manifested as embrittlement of the fibres in the mechanical tests, increased crosslinking rate in the rheological tests, formation of carbonyl and hydroxyl groups and changes in the nature of the carbon-hydrogen bonds in the FTIR, diminished thermal properties in TGA, and transverse cracks in the SEM photos. DSC was found to be an inaccurate technique for estimating the degradation level of PEEK fibres, whereas the carbonyl index measured by FTIR was found to be the most convenient technique. © 2014 Elsevier Ltd. All rights reserved.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Chemistry and Bioengineering, Research group: Supramolecular photochemistry, Tampere University of Technology
Authors: Mylläri, V., Ruoko, T. P., Järvelä, P.
Number of pages: 7
Pages: 278-284
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Polymer Degradation and Stability
Volume: 109
ISSN (Print): 0141-3910
Ratings:
Scopus rating (2016): SJR 1.029 SNIP 1.582 CiteScore 3.57
Scopus rating (2015): SJR 1.22 SNIP 1.634 CiteScore 3.48
Scopus rating (2014): SJR 1.278 SNIP 1.888 CiteScore 3.37
Scopus rating (2013): SJR 1.341 SNIP 2.12 CiteScore 3.35
Scopus rating (2012): SJR 1.423 SNIP 2.105 CiteScore 3.25
Scopus rating (2011): SJR 1.347 SNIP 2.099 CiteScore 3.17
Scopus rating (2010): SJR 1.237 SNIP 1.642
Scopus rating (2009): SJR 1.349 SNIP 1.623
Scopus rating (2008): SJR 1.281 SNIP 1.745
Scopus rating (2007): SJR 1.451 SNIP 1.557
Scopus rating (2006): SJR 1.367 SNIP 1.787
Scopus rating (2005): SJR 1.197 SNIP 1.461
Scopus rating (2004): SJR 1.062 SNIP 1.43
Scopus rating (2003): SJR 0.922 SNIP 1.24
Scopus rating (2002): SJR 0.821 SNIP 1.058
Scopus rating (2001): SJR 0.93 SNIP 1.151
Scopus rating (2000): SJR 0.685 SNIP 1.077
Scopus rating (1999): SJR 0.75 SNIP 1.194
Original language: English
Keywords: PEEK, Fibre, Ultraviolet, Rheology, POLY(ETHER ETHER KETONE), STRUCTURE/DEGRADABILITY RELATIONSHIPS, SCANNING CALORIMETRY, THERMAL-DEGRADATION, POLYPROPYLENE, PHOTODEGRADATION, POLYMERS, PHOTOOXIDATION, CRYSTALLINITY
Electronic versions:
The_effects_of_UV_irradiation_pre-print
DOIs:
10.1016/j.polymdegradstab.2014.08.003
High- and low-adhesive superhydrophobicity on the liquid flame spray-coated board and paper: structural effects on surface wetting and transition between the low- and high-adhesive states

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Energy and Process Engineering, Department of Physics, Engineering materials science and solutions (EMASS)
Authors: Teisala, H., Tuominen, M., Aromaa, M., Stepien, M., Mäkelä, J. M., Saarinen, J. J., Toivakka, M., Kuusipalo, J.
Pages: 447-455
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Colloid and Polymer Science
Volume: 291
Issue number: 2
ISSN (Print): 0303-402X
Ratings:
Scopus rating (2016): SJR 0.575 SNIP 0.627 CiteScore 1.69
Scopus rating (2015): SJR 0.555 SNIP 0.758 CiteScore 1.81
Scopus rating (2014): SJR 0.655 SNIP 0.862 CiteScore 2.01
Scopus rating (2013): SJR 0.772 SNIP 0.948 CiteScore 2.29
Scopus rating (2012): SJR 0.896 SNIP 1.008 CiteScore 2.28
Scopus rating (2011): SJR 0.765 SNIP 1.012 CiteScore 2.2
Scopus rating (2010): SJR 0.942 SNIP 0.913
Scopus rating (2009): SJR 0.957 SNIP 0.863
Scopus rating (2008): SJR 0.803 SNIP 0.776
Scopus rating (2007): SJR 0.893 SNIP 0.774
Scopus rating (2006): SJR 0.702 SNIP 0.712
Scopus rating (2005): SJR 0.713 SNIP 0.821
Scopus rating (2004): SJR 0.623 SNIP 0.836
Scopus rating (2003): SJR 0.82 SNIP 0.927
Scopus rating (2002): SJR 0.871 SNIP 0.94
Scopus rating (2001): SJR 0.951 SNIP 0.92
Scopus rating (2000): SJR 0.915 SNIP 1.031
Scopus rating (1999): SJR 0.943 SNIP 1.15
Original language: English
DOIs:
10.1007/s00396-012-2833-5
The effect of flame treatment on surface properties and heat sealability of low-density polyethylene coating

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Energy and Process Engineering, Engineering materials science and solutions (EMASS)
Authors: Tuominen, M., Ek, M., Saloranta, P., Toivakka, M., Kuusipalo, J.
Pages: 201-214
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Packaging Technology and Science
Volume: 26
Issue number: 4
ISSN (Print): 0894-3214
Ratings:
Scopus rating (2016): SJR 0.608 SNIP 0.905 CiteScore 1.76
Scopus rating (2015): SJR 0.522 SNIP 1.112 CiteScore 1.73
Scopus rating (2014): SJR 0.665 SNIP 1.619 CiteScore 1.81
Scopus rating (2013): SJR 0.703 SNIP 1.331 CiteScore 1.75
Scopus rating (2012): SJR 0.522 SNIP 1.602 CiteScore 1.3
Scopus rating (2011): SJR 0.674 SNIP 1.438 CiteScore 1.45
Scopus rating (2010): SJR 0.721 SNIP 1.14
Scopus rating (2009): SJR 0.753 SNIP 1.049
Scopus rating (2008): SJR 0.814 SNIP 1.006
Scopus rating (2007): SJR 0.395 SNIP 1.099
Scopus rating (2006): SJR 0.339 SNIP 0.748
Scopus rating (2005): SJR 0.214 SNIP 0.668
Scopus rating (2004): SJR 0.325 SNIP 0.598
Scopus rating (2003): SJR 0.354 SNIP 0.584
Scopus rating (2002): SJR 0.244 SNIP 0.474
Scopus rating (2001): SJR 0.216 SNIP 0.728
Scopus rating (2000): SJR 0.203 SNIP 0.481
Scopus rating (1999): SJR 0.278 SNIP 0.656
Original language: English
DOIs:
10.1002/pts.1975

Bibliographical note
Article first published online: 14 May 2012 : Poistettu tupla r=1325 portfolio13<br/>Contribution: organisation=epr,FACT1=1<br/>Publisher name: John Wiley & Sons
Source: researchoutputwizard
Source-ID: 3580
Research output: Scientific - peer-review Article

Wettability conversion on the liquid flame spray generated superhydrophobic TiO2 nanoparticle coating on paper and board by photocatalytic decomposition of spontaneously accumulated carbonaceous overlayer

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Energy and Process Engineering, Department of Physics, Engineering materials science and solutions (EMASS)
Authors: Teisala, H., Tuominen, M., Stepien, M., Haapanen, J., Mäkelä, J. M., Saarinen, J. J., Toivakka, M., Kuusipalo, J.
Pages: 391-408
Publication date: 2013
Peer-reviewed: Yes
Adhesion of Extrusion-Coated Polymer Sealing Layers to a Fiber-Based Packaging Material with an Atomic Layer Deposited Aluminum Oxide Surface Coating

General information
State: Published
Ministry of Education publication type: A1 Journal-article-refereed
Organisations: Department of Energy and Process Engineering
Authors: Lahtinen, K., Johansson, P., Kääriäinen, T., Cameron, D. C.
Pages: 1985-1990
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Polymer Engineering and Science
Volume: 52
Issue number: 9
ISSN (Print): 0032-3888
Ratings:
Scopus rating (2016): SJR 0.579 SNIP 0.835 CiteScore 1.61
Scopus rating (2015): SJR 0.563 SNIP 0.913 CiteScore 1.65
Scopus rating (2014): SJR 0.555 SNIP 1.092 CiteScore 1.4
Scopus rating (2013): SJR 0.569 SNIP 1.037 CiteScore 1.47
Scopus rating (2012): SJR 0.691 SNIP 1.298 CiteScore 1.51
Scopus rating (2011): SJR 0.654 SNIP 1.074 CiteScore 1.5
Atmospheric synthesis of superhydrophobic TiO₂ nanoparticle deposits in a single step using Liquid Flame Spray

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Aerosol Physics, Department of Materials Science, Department of Physics, Department of Energy and Process Engineering, Engineering materials science and solutions (EMASS), Urban circular bioeconomy (UrCirBio)
Pages: 57-68
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Journal of Aerosol Science
Volume: 52
ISSN (Print): 0021-8502
Scopus rating (2016): SJR 0.843 SNIP 1.199 CiteScore 2.21
Scopus rating (2015): SJR 1.072 SNIP 1.318 CiteScore 2.47
Scopus rating (2014): SJR 1.068 SNIP 1.586 CiteScore 2.72
Scopus rating (2013): SJR 1.187 SNIP 1.858 CiteScore 2.9
Scopus rating (2012): SJR 1.294 SNIP 1.638 CiteScore 2.64
Scopus rating (2011): SJR 1.137 SNIP 1.623 CiteScore 2.63
Scopus rating (2010): SJR 1.169 SNIP 1.604
Scopus rating (2009): SJR 1.457 SNIP 1.782
Scopus rating (2008): SJR 1.375 SNIP 1.353
Scopus rating (2007): SJR 0.999 SNIP 0.892
Scopus rating (2006): SJR 1.044 SNIP 0.929
Scopus rating (2005): SJR 0.812 SNIP 0.737
Scopus rating (2004): SJR 1.278 SNIP 1.932
Scopus rating (2003): SJR 0.616 SNIP 0.554
Flame deposition of superhydrophobic and superhydrophilic nanoparticle coating on paperboard materials

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Physics, Department of Energy and Process Engineering, Engineering materials science and solutions (EMASS)
Authors: Aromaa, M., Haapanen, J., Teisala, H., Tuominen, M., Kuusipalo, J., Stepien, M., Saarinen, J., Toivakka, M., Mäkelä, J. M.
Pages: 365-367
Publication date: 2012

Host publication information
Title of host publication: Nanotechnology 2012: Advanced Materials, CNTs, Particles, Films and Composites - 2012 NSTI Nanotechnology Conference and Expo, NSTI-Nanotech 2012, Santa Clara, CA, USA, 18-21 June 2012
Publisher: Nano Science and Technology Institute NSTI

Publication series
Name: Nanotechnology Conference and Expo Nanotech

Bibliographical note
ei ut-numeroa 9.8.2013<br/>Contribution: organisation=fys,FACT1=0.5<br/>Contribution: organisation=epr,FACT2=0.5<br/>Publisher name: Nano Science and Technology Institute NSTI
Source: researchoutputwizard
Source-ID: 3865
Research output: Scientific - peer-review » Conference contribution

Nanoscale surface processing of extrusion coated substrates and plastic films with atmospheric plasma activation and deposition

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Lahti, J., Lavonen, J.
Pages: 588-600
Publication date: 2012

Host publication information
Publisher: TAPPI Press; Curran Associates, Inc
ISBN (Print): 978-1-62276-841-7

Publication series
Name: TAPPI PLACE Conference

Bibliographical note
Nanostructures Increase Water Droplet Adhesion on Hierarchically Rough Superhydrophobic Surfaces

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Aerosol Physics, Department of Energy and Process Engineering, Department of Physics, Engineering materials science and solutions (EMASS)
Authors: Teisala, H., Tuominen, M., Aromaa, M., Stepien, M., Mäkelä, J. M., Saarinen, J. J., Toivakka, M., Kuusipalo, J.
Pages: 3138-3145
Publication date: 2012
Peer-reviewed: Yes
Publication information
Journal: Langmuir
Volume: 28
Issue number: 6
ISSN (Print): 0743-7463
Ratings:
Scopus rating (2016): SJR 1.55 SNIP 1.188 CiteScore 3.99
Scopus rating (2015): SJR 1.686 SNIP 1.308 CiteScore 4.33
Scopus rating (2014): SJR 1.816 SNIP 1.391 CiteScore 4.59
Scopus rating (2013): SJR 1.895 SNIP 1.356 CiteScore 4.55
Scopus rating (2012): SJR 2.177 SNIP 1.382 CiteScore 4.37
Scopus rating (2011): SJR 2.051 SNIP 1.357 CiteScore 4.42
Scopus rating (2010): SJR 2.148 SNIP 1.4
Scopus rating (2009): SJR 2.156 SNIP 1.351
Scopus rating (2008): SJR 2.383 SNIP 1.34
Scopus rating (2007): SJR 2.449 SNIP 1.434
Scopus rating (2006): SJR 2.375 SNIP 1.428
Scopus rating (2005): SJR 2.157 SNIP 1.463
Scopus rating (2004): SJR 1.963 SNIP 1.458
Scopus rating (2003): SJR 1.953 SNIP 1.4
Scopus rating (2002): SJR 2.011 SNIP 1.489
Scopus rating (2001): SJR 2.01 SNIP 1.382
Scopus rating (2000): SJR 2.039 SNIP 1.479
Scopus rating (1999): SJR 1.719 SNIP 1.496
Original language: English
DOIs:
10.1021/la203155d

Bibliographical note
Contribution: organisation=epr,FACT1=0.5<br/>
Contribution: organisation=fys,FACT2=0.5<br/>
Publisher name: American Chemical Society
Source: researchoutputwizard
Source-ID: 5410
Research output: Scientific - peer-review › Article

Surface chemical analysis of photocatalytic wettability conversion of TiO2 nanoparticle coating

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Aerosol Physics, Department of Energy and Process Engineering, Department of Physics, Engineering materials science and solutions (EMASS)
The Effect of ELF electric fields on Implantable Cardioverter Defibrillators (ICD)

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Energy and Process Engineering
Authors: Gonzalez, J. A., Tarao, H., Korpinen, L.
Number of pages: 3
Pages: 104-106
Publication date: 2012

Host publication information
Title of host publication: The Bioelectromagnetics Society 34th Annual Meeting, June 17, 2012 - June 22, 2012, Brisbane, Australia
Publisher: The Bioelectromagnetics Society
ISBN (Print): 978-0-646-57844-6

Publication series
Name: The Bioelectromagnetics Society Annual Meeting
Links:

Bibliographical note
ei ut-numeroa 13.8.2013<br/>Contribution: organisation=epr,FACT1=1<br/>Publisher name: The Bioelectromagnetics Society
Source: researchoutputwizard
Source-ID: 4099
Research output: Scientific - peer-review › Conference contribution

The effects of coating structure and water-holding capacity on the oxygen-scavenging capacity of enzymes embedded in the coating layer

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Top layer coatability on barrier coatings

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Energy and Process Engineering
Authors: Bollström, R., Tuominen, M., Määttänen, A., Peltonen, J., Toivakka, M.
Pages: 26-32
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Progress in Organic Coatings
Volume: 73
Issue number: 1
ISSN (Print): 0300-9440
Ratings:
Scopus rating (2016): SJR 0.852 SNIP 1.3 CiteScore 2.89
Scopus rating (2015): SJR 0.849 SNIP 1.39 CiteScore 2.84
Scopus rating (2014): SJR 0.992 SNIP 1.566 CiteScore 2.8
Scopus rating (2013): SJR 1.03 SNIP 1.663 CiteScore 2.58
Scopus rating (2012): SJR 1.043 SNIP 1.862 CiteScore 2.39
Scopus rating (2011): SJR 0.884 SNIP 1.606 CiteScore 2.34
Scopus rating (2010): SJR 0.983 SNIP 1.537
Scopus rating (2009): SJR 0.867 SNIP 1.333
Scopus rating (2008): SJR 0.829 SNIP 1.298
Scopus rating (2007): SJR 1.088 SNIP 1.362
Scopus rating (2006): SJR 1.243 SNIP 1.598
Scopus rating (2005): SJR 0.928 SNIP 1.168
Scopus rating (2004): SJR 0.692 SNIP 1.121
Scopus rating (2003): SJR 0.604 SNIP 1.497
Scopus rating (2002): SJR 1.037 SNIP 1.312
Scopus rating (2001): SJR 0.619 SNIP 0.92
Scopus rating (2000): SJR 0.857 SNIP 1.132
Scopus rating (1999): SJR 0.723 SNIP 1.167
Original language: English
DOIs:
10.1016/j.porgcoat.2011.08.015
Links:
http://www.elsevier.com/locate/porgcoat
Toward more controlled, nanoscale barrier layers in packaging

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Energy and Process Engineering
Authors: Lahtinen, K., Johansson, P., Kääriäinen, T., Maydannik, P., Cameron, D., Kuusipalo, J.
Number of pages: 3
Pages: 1-3
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Plastics Research Online
Issue number: 17th August
Original language: English
DOIs: 10.2417/spepro.004237

Bibliographical note
17 August 2012. ei ut-numeroa 20.8.2013
Contribution: organisation=epr,FACT1=1
Publisher name: Society of Plastics Engineers (SPE)
Source: researchoutputwizard
Source-ID: 4623
Research output: Scientific - peer-review › Article

Two-component aerosol nanoparticle coating for paperboard on roll-to-roll process

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Research area: Aerosol Physics, Department of Physics, Department of Energy and Process Engineering
Authors: Haapanen, J., Aromaa, M., Teisala, H., Tuominen, M., Stepien, M., Saarinen, J., Toivakka, M., Kuusipalo, J., Mäkelä, J.
Number of pages: 1
Pages: 1-1
Publication date: 2012

Host publication information
Title of host publication: EAC-2012 Granada, European Aerosol Conference, 2-7 Sept 2012, Granada, Spain
Publisher: EAA, AECTA

Publication series
Name: European Aerosol Conference EAC
Links:

Bibliographical note
13.8.2013
Contribution: organisation=fys,FACT1=0.5
Contribution: organisation=epr,FACT2=0.5
Publisher name: EAA, AECTA
Source: researchoutputwizard
Source-ID: 4117
Research output: Scientific › Conference contribution

Adhesion Mechanism of Water Droplets on Hierarchically Rough Superhydrophobic Rose Petal Surface

General information
State: Published
Atmospheric Plasma Treatment of Plastic Packaging Film: Effects on Surface Properties and UV Inkjet Printability

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Energy and Process Engineering, Engineering materials science and solutions (EMASS)
Authors: Lahti, J., Eiroma, K., Tenhunen, T., Pykönen, M., Toivakka, M., Tuominen, M.
Number of pages: 31
Pages: 1-31
Publication date: 2011

Host publication information
Title of host publication: 13th TAPPI European PLACE Conference, Bregenz, Austria, 30 May - 1 June, 2011
Place of publication: Norcross, GA
Publisher: TAPPI

Publication series
Name: TAPPI European PLACE Conference
Publisher: TAPPI
Links:
http://www.tappi.org/content/events/11EUROPLACE/papers/16_1.pdf

Bibliographical note
ei ut-numeroa 29.3.2014<br/>Contribution: organisation=epr,FACT1=1
Source: researchoutputwizard
Source-ID: 6528
Research output: Scientific - peer-review › Conference contribution
Effects of flame and corona treatment on extrusion coated paper properties

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Energy and Process Engineering, Engineering materials science and solutions (EMASS)
Authors: Tuominen, M., Lahti, J., Kuusipalo, J.
Pages: 29-36
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: TAPPI Journal
Volume: 10
Issue number: 10
ISSN (Print): 0734-1415
Ratings:
Scopus rating (2016): SJR 0.406 SNIP 0.494
Scopus rating (2015): SJR 0.441 SNIP 0.741
Scopus rating (2014): SJR 0.44 SNIP 0.625
Scopus rating (2013): SJR 0.429 SNIP 0.722
Scopus rating (2012): SJR 0.326 SNIP 0.809
Scopus rating (2011): SJR 0.545 SNIP 1.05
Scopus rating (2010): SJR 0.737 SNIP 1.353
Scopus rating (2009): SJR 1.156 SNIP 0.755
Scopus rating (2008): SJR 0.838 SNIP 1.091
Scopus rating (2007): SJR 1.561 SNIP 1.188
Scopus rating (2006): SJR 1.205 SNIP 1.322
Scopus rating (2005): SJR 0.857 SNIP 0.97
Scopus rating (2004): SJR 1.185 SNIP 0.988
Scopus rating (2003): SJR 0.797 SNIP 0.709
Scopus rating (2002): SJR 1.275 SNIP 1.811
Scopus rating (2001): SJR 0.477 SNIP 1.424
Scopus rating (2000): SJR 0.652 SNIP 0.927
Scopus rating (1999): SJR 0.769 SNIP 0.791
Original language: English

Bibliographical note
Contribution: organisation=epr pap,FACT1=1
Source: researchoutputwizard
Source-ID: 7422
Research output: Scientific - peer-review » Article

Nanoparticle Deposition from Liquid Flame Spray onto Moving Roll-to-Roll Paperboard Material

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Physics, Department of Energy and Process Engineering, Engineering materials science and solutions (EMASS)
The name of the thesis: Atmospheric Plasma Treatment in Extrusion Coating, Topic: The Effect of Flame Treatment on the Sealability of Extrusion Coated Paper

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Energy and Process Engineering
Authors: Tuominen, M.
Number of pages: 5
Pages: 1-5
Publication date: 2011

Host publication information
Title of host publication: PaPSaT, International Doctoral Programme in Pulp and Paper Science and Technology in Finland, Yearbook 2011
Place of publication: Espoo
Publisher: Aalto University School of science and technology
Editor: Kärkkäinen, S.

Bibliographical note
Contribution: organisation=epr pap,FACT1=1
Source: researchoutputwizard
Source-ID: 7421
Research output: Scientific - peer-review › Chapter

Top layer coatability on barrier coatings

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Energy and Process Engineering
Authors: Bollström, R., Tuominen, M., Määttänen, A., Peltonen, J., Toivakka, M.
Number of pages: 11
Pages: 1-11
Publication date: 2011

Host publication information
Title of host publication: TAPPI's PaperCon 2011, May 1-4, 2011, Covington, KY, USA. Paper 360 - Special PaperCon Edition
Place of publication: Norcross, GA
Publisher: TAPPI

Publication series
Name: TAPPI International Conference Papercon
Publisher: TAPPI
Links:

Bibliographical note
ei ut-numeroa 9.11.2013<br/>Contribution: organisation=epr pap,FACT1=1
Source: researchoutputwizard
Source-ID: 5790
Research output: Scientific - peer-review › Conference contribution
Utilisation of continuous atomic layer deposition process for barrier enhancement of extrusion-coated paper

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Energy and Process Engineering, Engineering materials science and solutions (EMASS)
Authors: Lahtinen, K., Maydannik, P., Johansson, P., Kääriäinen, T., Cameron, D. C., Kuusipalo, J.
Pages: 3916-3922
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Surface and Coatings Technology
Volume: 205
Issue number: 15
ISSN (Print): 0257-8972
Ratings:
Scopus rating (2016): SJR 0.874 SNIP 1.359 CiteScore 2.56
Scopus rating (2015): SJR 0.871 SNIP 1.415 CiteScore 2.46
Scopus rating (2014): SJR 0.998 SNIP 1.681 CiteScore 2.44
Scopus rating (2013): SJR 1.057 SNIP 1.859 CiteScore 2.58
Scopus rating (2012): SJR 1.049 SNIP 1.658 CiteScore 2.2
Scopus rating (2011): SJR 1.053 SNIP 1.851 CiteScore 2.38
Scopus rating (2010): SJR 1.155 SNIP 1.66
Scopus rating (2009): SJR 1.449 SNIP 1.526
Scopus rating (2008): SJR 1.479 SNIP 1.564
Scopus rating (2007): SJR 1.165 SNIP 1.509
Scopus rating (2006): SJR 1.276 SNIP 1.709
Scopus rating (2005): SJR 1.252 SNIP 1.666
Scopus rating (2004): SJR 1.269 SNIP 1.498
Scopus rating (2003): SJR 1.276 SNIP 1.516
Scopus rating (2002): SJR 1.208 SNIP 1.183
Scopus rating (2001): SJR 1.115 SNIP 1.181
Scopus rating (2000): SJR 0.981 SNIP 1.03
Scopus rating (1999): SJR 1.062 SNIP 1.167
Original language: English
DOIs: 10.1016/j.surfcoat.2011.02.009

Bibliographical note
Contribution: organisation=epr pap,FACT1=1
Source: researchoutputwizard
Source-ID: 6531
Research output: Scientific - peer-review › Article

Atomic layer deposition process for barrier applications of flexible packaging

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Energy and Process Engineering
Authors: Johansson, P., Lahtinen, K., Kuusipalo, J., Kääriäinen, T., Maydannik, P., Cameron, D.
Number of pages: 12
Pages: 1-12
Publication date: 2010

Host publication information
Title of host publication: TAPPI 2010 PLACE Conference, April 18-21, 2010, Albuquerque NM, USA

Bibliographical note
Contribution: organisation=epr,FACT1=1
Bio-Hybrid Nanocomposite Coatingas from Sonicated Chitosan and Nanoclay

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Energy and Process Engineering
Authors: Vartiainen, J., Tuominen, M., Nättinen, K.
Pages: 3638-3647
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Journal of Applied Polymer Science
Volume: 116
Issue number: 6
ISSN (Print): 0021-8995

Ratings:
Scopus rating (2016): SJR 0.532 SNIP 0.724 CiteScore 1.73
Scopus rating (2015): SJR 0.574 SNIP 0.827 CiteScore 1.74
Scopus rating (2014): SJR 0.658 SNIP 0.964 CiteScore 1.76
Scopus rating (2013): SJR 0.628 SNIP 1.085 CiteScore 1.71
Scopus rating (2012): SJR 0.658 SNIP 1.081 CiteScore 1.57
Scopus rating (2011): SJR 0.601 SNIP 0.965 CiteScore 1.45
Scopus rating (2010): SJR 0.679 SNIP 0.909
Scopus rating (2009): SJR 0.697 SNIP 0.825
Scopus rating (2008): SJR 0.647 SNIP 0.822
Scopus rating (2007): SJR 0.678 SNIP 0.931
Scopus rating (2006): SJR 0.782 SNIP 1.145
Scopus rating (2005): SJR 0.779 SNIP 0.912
Scopus rating (2004): SJR 0.774 SNIP 0.962
Scopus rating (2003): SJR 0.816 SNIP 1.067
Scopus rating (2002): SJR 0.866 SNIP 1.084
Scopus rating (2001): SJR 0.964 SNIP 1.157
Scopus rating (2000): SJR 0.864 SNIP 1.157
Scopus rating (1999): SJR 0.978 SNIP 1.277

Original language: English
DOIs:
10.1002/app.31922

Bibliographical note
Contribution: organisation=epr pap,FACT1=1

Development of sustainable paper coatings using nanoscale industrial

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Energy and Process Engineering
Authors: Markert, F., Breedveld, L., Lahti, J., Vangeneugden, D.
Pages: 80-84
Publication date: 2010

Host publication information
Digital imaging measurement of dense multiphase flows in industrial processes

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Energy and Process Engineering
Authors: Honkanen, M., Eloranta, H., Saarenrinne, P.
Pages: 25-32
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Flow Measurement and Instrumentation
Volume: 21
Issue number: 1
ISSN (Print): 0955-5986
Ratings:
Scopus rating (2016): SJR 0.53 SNIP 1.355 CiteScore 1.45
Scopus rating (2015): SJR 0.533 SNIP 1.642 CiteScore 1.67
Scopus rating (2014): SJR 0.51 SNIP 1.647 CiteScore 1.52
Scopus rating (2013): SJR 0.567 SNIP 1.927 CiteScore 1.6
Scopus rating (2012): SJR 0.491 SNIP 1.697 CiteScore 1.35
Scopus rating (2011): SJR 0.602 SNIP 1.641 CiteScore 1.38
Scopus rating (2010): SJR 0.591 SNIP 1.511
Scopus rating (2009): SJR 0.466 SNIP 1.538
Scopus rating (2008): SJR 0.616 SNIP 1.821
Scopus rating (2007): SJR 0.391 SNIP 1.363
Scopus rating (2006): SJR 0.349 SNIP 1.268
Scopus rating (2005): SJR 0.419 SNIP 1.134
Scopus rating (2004): SJR 0.332 SNIP 1.142
Scopus rating (2003): SJR 0.332 SNIP 0.864
Scopus rating (2002): SJR 0.477 SNIP 1.057
Scopus rating (2001): SJR 0.29 SNIP 0.617
Scopus rating (2000): SJR 0.916 SNIP 1.312
Scopus rating (1999): SJR 0.361 SNIP 0.625
Original language: English
DOIs:
10.1016/j.flowmeasinst.2009.11.001

Effect of fibre properties on flocculation and fractionation of cellulosic fibres in dry state

General information
State: Published
Influence of Atmospheric Plasma Treatment on Surface Properties and Inkjet Printability of Plastic Packaging Film

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Energy and Process Engineering
Authors: Lahti, J., Eiroma, K., Tenhunen, T., Pykönen, M., Toivakka, M.
Pages: 197-203
Publication date: 2010

Host publication information
Title of host publication: Advances in Printing and Media Technology
Editors: Enlund, N., Lovrecek, M.
ISBN (Print): 978-3-9812704-2-6

Bibliographical note
Contribution: organisation=epr pap,FACT1=1
Source: researchoutputwizard
Source-ID: 8549
Research output: Scientific - peer-review › Chapter

The name of the thesis: Surface Treatment in Extrusion Coating, Topic: The Influence of Corona and Flame Treatment on Sealability of Extrusion Coated Paper

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Energy and Process Engineering
Authors: Tuominen, M.
Number of pages: 5
Pages: 1-5
Publication date: 2010

Host publication information
Title of host publication: PaPSaT, International Doctoral Programme in Pulp and Paper Science and Technology in Finland, Yearbook 2010
Editor: Kärkkäinen, S.

Bibliographical note
Contribution: organisation=epr pap,FACT1=1
Source: researchoutputwizard
Source-ID: 9444
Research output: Scientific - peer-review › Chapter

Two-phase PIV/PTV measurement of bubbly flow across pin fins in a micro-channel