**Green, Supercritical CO\(_2\) Assisted Processing of Functional Surfaces**

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**Abstract:** There is urgent need for manufacturing of complex structures and large surfaces with sustainable ways and supercritical CO\(_2\) assisted processing techniques will offer one promising way to produce ceramic nanoparticles and well-defined ordered structures and surface topographies. TiO\(_2\) and Zn-based materials are possible to produce by hybrid manufacturing technologies combining e.g. sol-gel, ablation and chemical growth in CO\(_2\) environment. This study sustainable manufacturing routes of functional ceramics and their structure and properties.

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**Nano-Manipulation, Nano-Manufacturing, Nano-Measurements by New Smart Material-Based Mechanical Nanotools**

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**Abstract:** Recent progress in the study of new functional materials, such as Ti(NiCu) intermetallic with shape memory effect (SME), opens up exciting possibilities for the design reconfigurable micro- and nano-structures and for operating mechanical nanotools controlled by external fields or heat. This report gives an overview of physical effects, in particular, solid state phase transitions and accompanying phenomena in alloys and composites exhibiting SME. The limitations pertaining to the minimum size of the nanomechanical devices exhibiting shape memory effect that arise due to the solid state phase transitions are now under discussion and have not been completely understood yet. The modern nanotechnologies allow designing of the mechanical micro- and nanotools, such as nanotweezers, nanopinchers etc., with an active layer thickness of about several tenths of nm, and whose overall size is below 1 \(\mu\)m. The nanotools with SME can be controlled by heating as well as by magnetic field activation in ferromagnetic alloys exhibiting SME, such as Ni2MnGa. 3D nanomanipulation is demonstrated by composite nanotweezers with SME in different nanoobjects, such as CNTs, nanowires, nanowhiskers, bionanoobjects, DNA, etc. In these devices, the surface interactions and Casimir and van der Waals forces affect the process of nanomanipulation. The prospects of nanorobotics and manufacturing on nanoscale adapting the principle of mechanical bottom-up nanoassembly are discussed. In addition, nanoscale measurements can take advantage of 3D mechanical nanomanipulation, including transportation of analytes to nanosensors, elasticity measurements by nanotools with calibrated force, etc.