

Supplementary Information

Enhancing Piezoelectric Properties of Bacterial Cellulose Films by Incorporation of MnFe_2O_4 Nanoparticles

Nipaporn Sriplai¹, Rahul Mangayil², Arno Pammo³, Ville Santala², Sampo Tuukkanen³,
Supree Pinitsoontorn^{1,4,*}

¹Materials Science and Nanotechnology Program, Department of Physics, Faculty of Science, Khon Kaen University, Khon Kaen 40002, THAILAND

²Faculty of Engineering and Natural Sciences (ENS), Tampere University (TAU), Tampere FI-33101, FINLAND

³Faculty of Medicine and Health Technology (MET), Tampere University (TAU), Tampere FI-33101, FINLAND

⁴Institute of Nanomaterials Research and Innovation for Energy (IN-RIE), NANOTEC- KKU RNN on Nanomaterials Research and Innovation for Energy, Khon Kaen University, Khon Kaen 40002, THAILAND



Fig. S1. Optical images the BC hydrogel after the incorporation of MnFe_2O_4 nanoparticles by the co-precipitation method. The image on the right shows the cross-section of the hydrogel with the nanoparticles dispersed homogeneously throughout the samples.

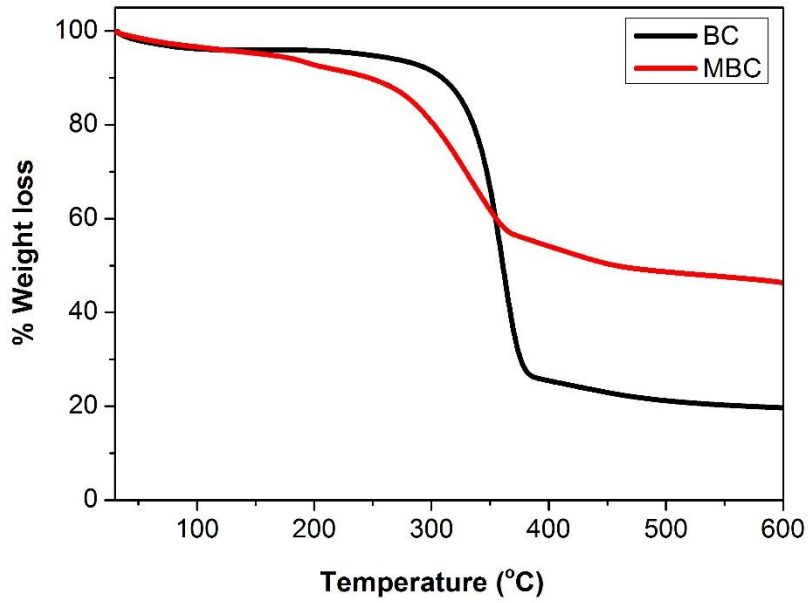


Fig. S2. TGA curves of the pristine BC and MBC composite films

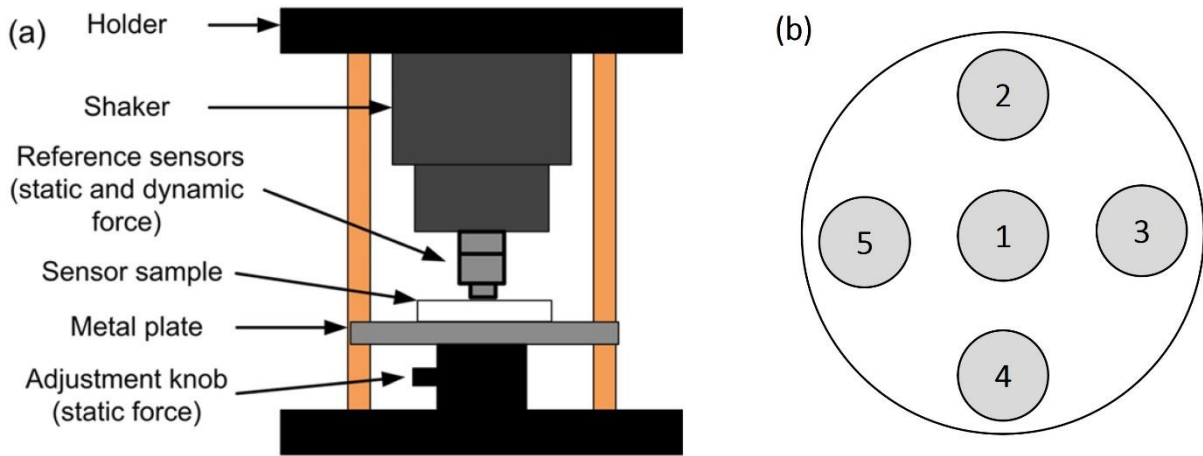


Fig. S3. (a) Setup for piezoelectric sensitivity measurement (b) Five excitation positions on the sample for each measurement.

Table S1. Nonlinearity measurement results presented as mean \pm standard deviation of data points deviations from the fitted polynomial

Measurement	Nonlinearity (pC/N)			
	BC	MBC	BC/BC/BC	BC/MBC/BC
Normal	2.93 \pm 1.90	2.73 \pm 1.51	1.53 \pm 1.19	2.91 \pm 2.09
Bending	4.00 \pm 2.77	2.05 \pm 1.27	2.93 \pm 1.59	2.98 \pm 1.61