FEASIBLE PATHWAY TO DEVELOPED MULTIFUNCTIONAL HYBRID LOW-COST MATERIALS BASED ON BACTERIAL CELLULOSE

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Bacterial cellulose has been recently investigated as an attractive environmentally friendly material for the preparation of low-cost nanocomposites. The functionalization of cellulose with inorganic materials opens new pathways for the fabrication of novel multifunctional hybrid materials with promising properties. Bacterial cellulose was used as template for preparation of novel hybrid composites that gather together excellent properties of bacterial cellulose with the ones displayed by typical inorganic nanoparticles like optical, magnetic and electrical properties, luminescence, ionic conductivity and selectivity, as well as chemical or biochemical activity.

In this work bacterial cellulose was used as template for generation hybrid materials by the addition of titanium or vanadium oxides nanoparticles. These nanoparticles are of particular interest taking into account their properties which offer wide range of potential application; titanium dioxide nanoparticles with their electric and photocatalytic properties and vanadium oxide nanoparticles with their widely recognized photo-electrochromic properties.

We proposed a simple, rapid, low-cost pathway based on a diffusion step of sol-gel nanoparticles into swollen bacterial cellulose mat via orbital incubator. This alternative pathway allows to keeping intact the 3D network of the bacterial cellulose mat while sol-gel nanoparticles are formed *in situ* and anchored on the nanofibrils surface.

The morphology of designed hybrid materials was investigated by AFM and SEM. In order to characterized obtained materials from the point of view of future applications different techniques were employed. On the one hand optical properties were analysed by UV-vis spectroscopy and spectrofluorimetry and on the other hand electrical properties were studied at nano and macroscale using electric force microscopy (EFM) and Keithley semiconductor analyser, respectively. Additionally XRD, FTIR and TGA techniques were also performed.

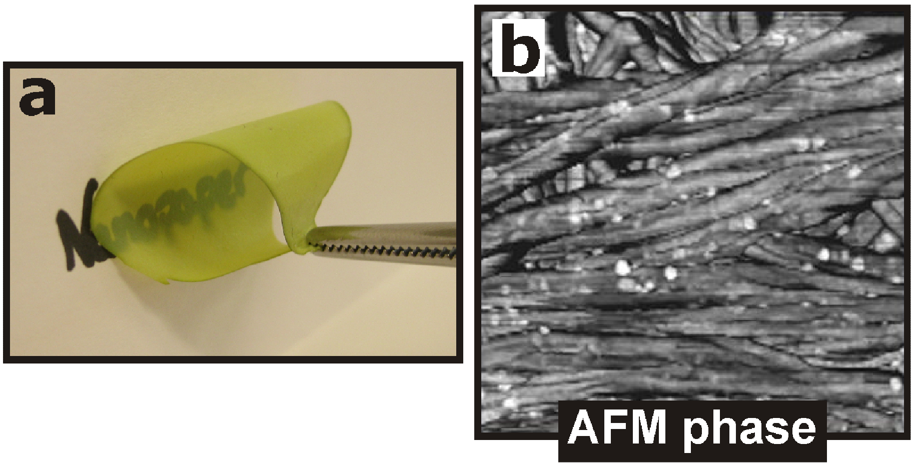

Figure 1. (a) Digital image and (b) AFM phase image (1 μm x 1 μm) of green vanadium oxide nanopaper.

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