Microscopic Characterization of Nanofibrillated Cellulose-Inorganic Nanoparticle Hybrid Systems

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Abstract

The establishment of a new bio-based industry largely depends on the development of new value-added products based on cellulose, by far the most abundant biopolymer on Earth. In line with this, an intensive research has been carried out over the last decade on nanostructured cellulose products, often combined with inorganic nanocompounds, with the potential of being used in a wide range of valuable applications (biomedical devices, polymer reinforcements, flexible electronic substrates, construction components…). In parallel, the availability of large volumes of nanocellulose at moderate cost is rapidly progressing with the setting-up of pilot-scale and commercial facilities. The market for these products will be growing millions of euros by 2020 [1]. In this work, a preliminary microscopic study of organic-inorganic hybrid nanocomposites was carried out using Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM) on different substrates. Three different types of cellulose substrates, i.e. cellulose microfibres, cellulose nanofibres and dicarboxylated cellulose nanofibres, the latter prepared as reported elsewhere [2,3], were combined with three types of inorganic nanoparticles, namely titanium dioxide, sodium montmorillonite and organically modified montmorillonite (see example in Figure 1). This study has a provided a better understanding over the structure of organic-inorganic hybrid systems made of nanocellulose and titanium dioxide/nanoclay, especially on the processability problems that may arise within the production of this type of hybrids.

References

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Figure

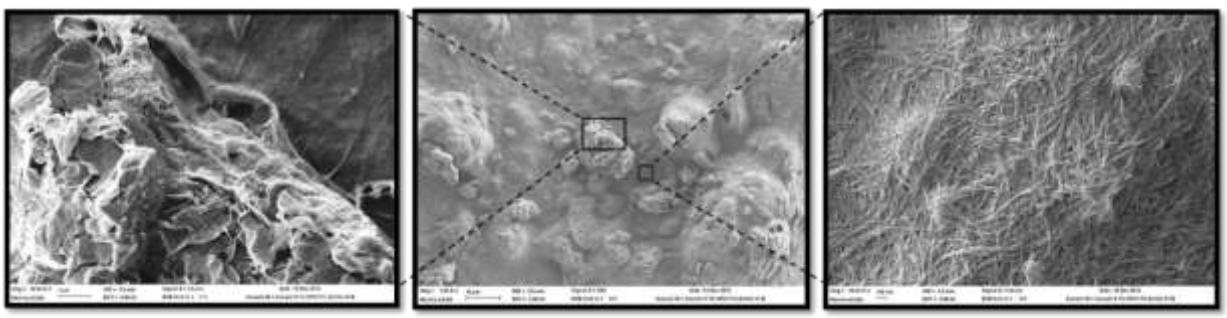

Figure 1: Organic-inorganic hybrid: inorganic clay (montmorillonite) and cellulose nanofibres