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Ferromagnetic iron oxide-cellulose nanocomposites prepared by ultrasonication

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XRD analysis

To evaluate the change of cellulose crystallinity during various synthesis procedures the crystallinity index (CI (%)) was calculated. The XRD deconvolution method was selected for this purpose because it leads to more accurate values of the crystallinity index as compared to the easier and popular Segal method[33]. The deconvolution of the X-ray diffraction patterns was performed with ORIGIN PRO 8.5 software considering the Gaussian function as the shape of the resolved peaks. The crystallinity index of the studied samples was calculated by the following equation[38]:

$$CI\ (\%) = 100 \times Sc / St$$

where Sc represents the area of the crystalline domain and St the area of the total domain, respectively. Note that the St values for the composite samples were adjusted by considering the contribution of the maghemite and goethite peaks.

The deconvolution of XRD patterns are shown in the Fig.1 and the CI values are listed in Table 1. One may note that the variation of the crystalinity index is in very good agreement with the crystalinity parameters calculated from IR spectra. As discussed for LOI, TCI and HBI, the CI parameter calculated from XRD suggests the fragmentation of the cellulose microfibers during the synthesis of the composite by ultrasonication.

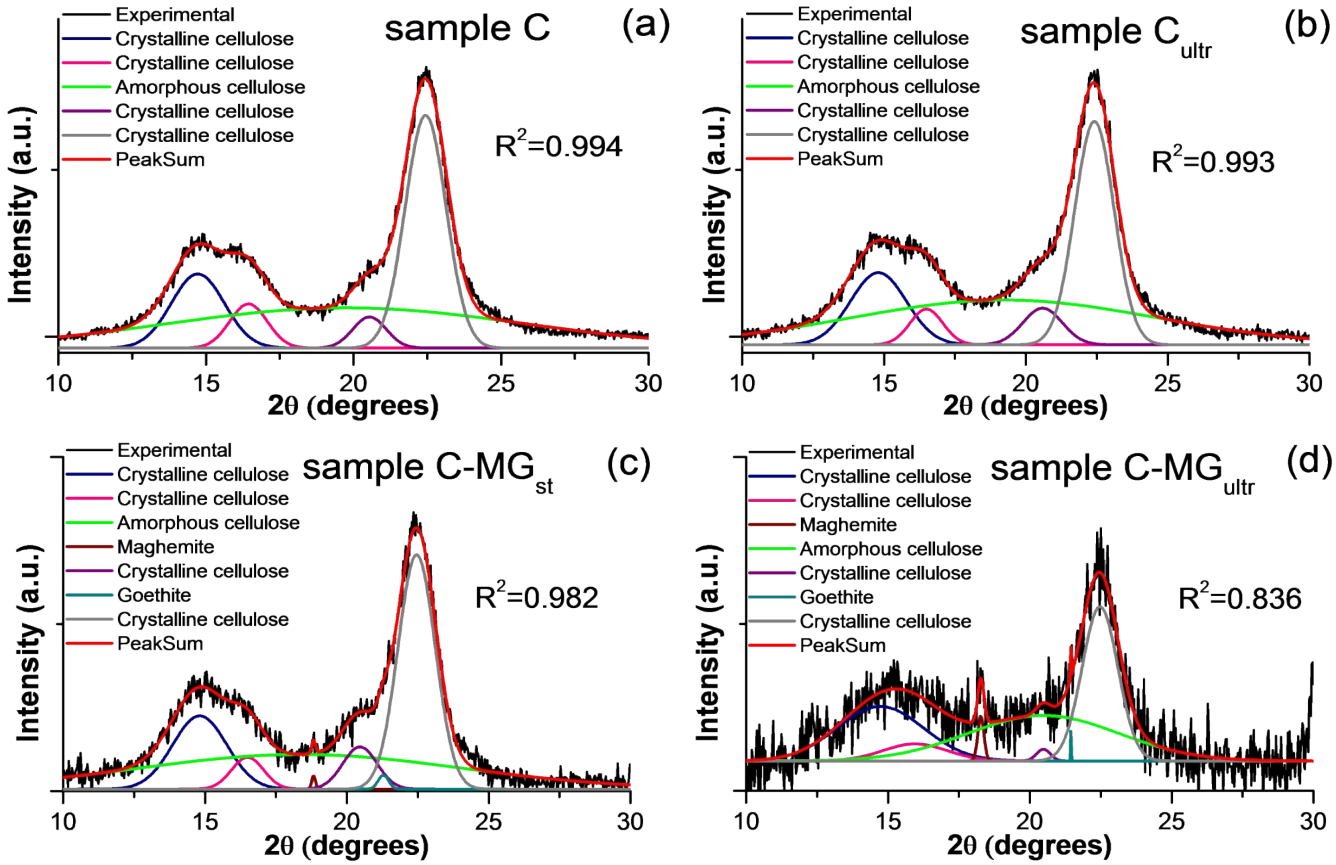

Fig. S1. Deconvolution of XRD patterns for (a) pristine cellulose: C, (b) cellulose ultrasonicated: Cultr, and composites obtained by (c) stirring: C-MGst and (d) ultrasonication: C-MGultr.

Electron microscopy

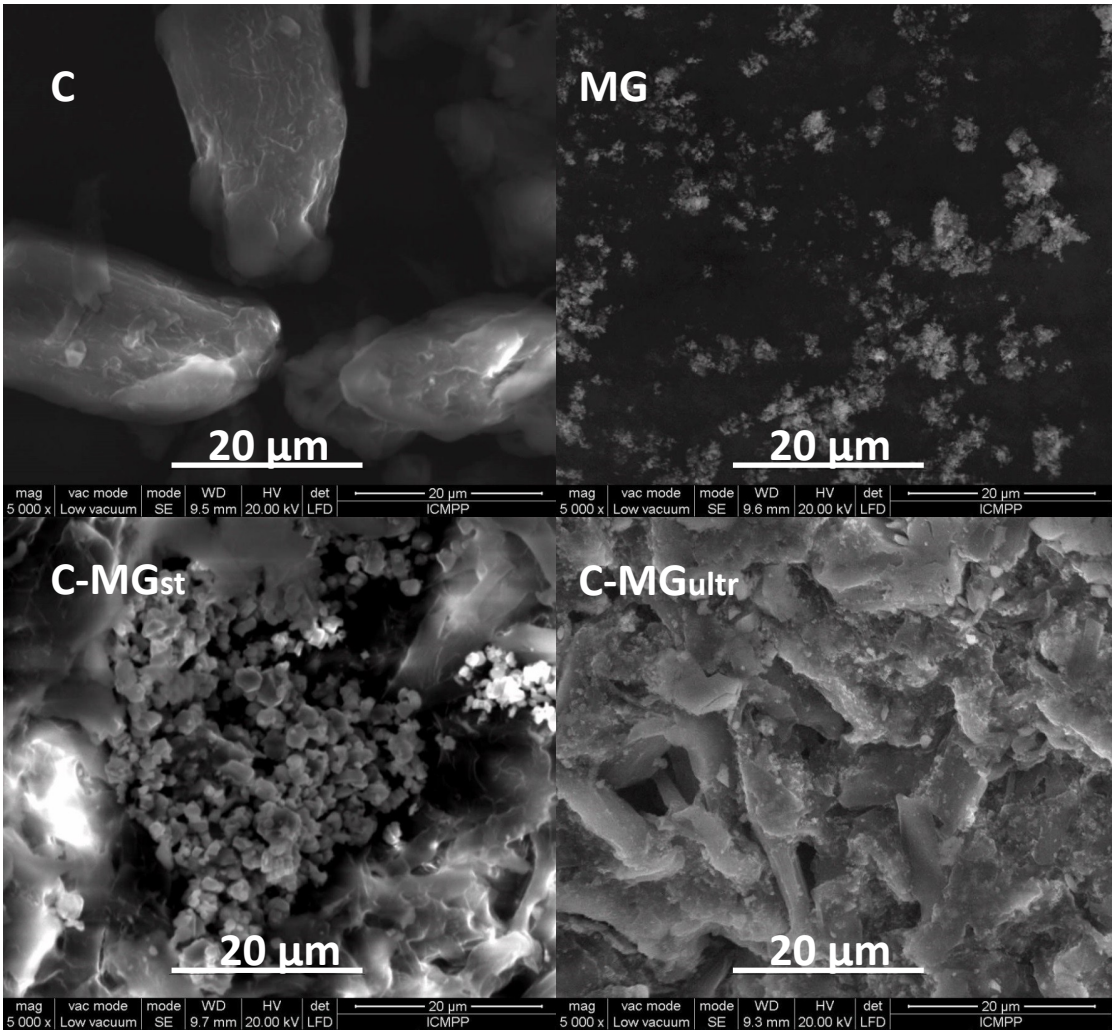

Fig. S2. SEM images of raw materials and of composites.

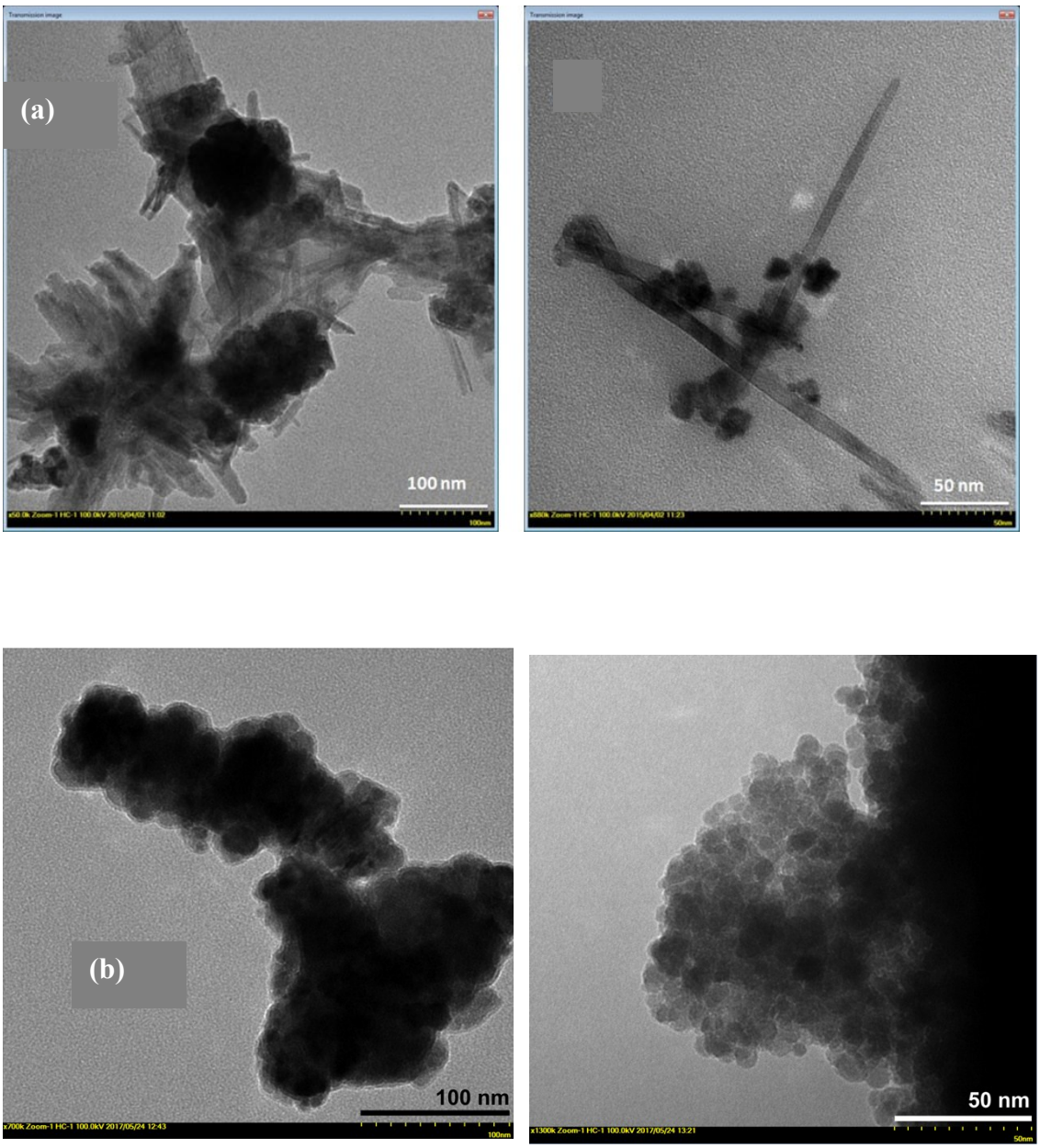

Fig. S3. TEM images of MG nanoparticles (a) and of C-MGst and C-MGultr samples (b) at different magnifications.

Magnetic properties

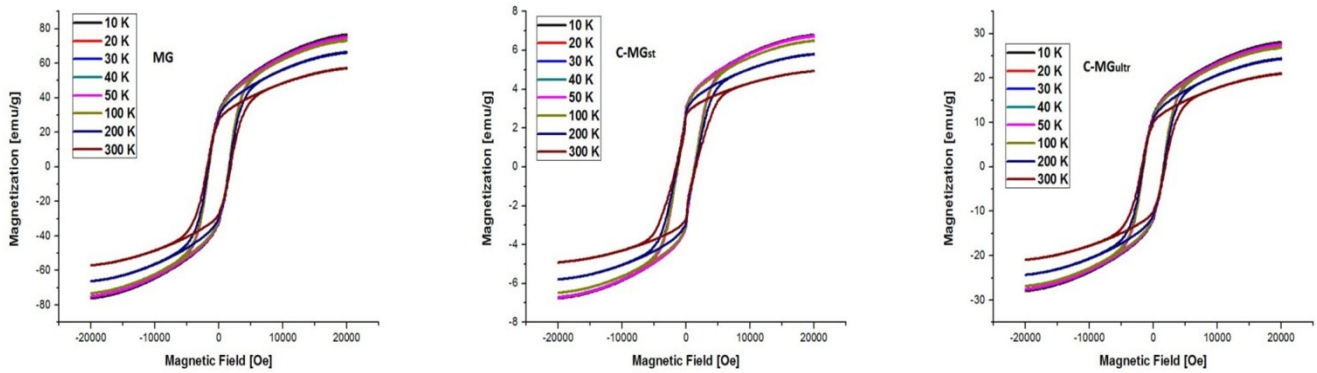

Fig. S4. Magnetization curve for MG, C-MGst and C-MGultr.