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Development of cellulose nanocrystal sheet embedded with carbon nanotubes for sensor application

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Cellulose is an important natural material, which is biocompatible and hydrophobic, and can form strong and stable stiff-chain monomolecular structures with film and hydrogel-forming properties. The focus of this investigation was to develop a mixed nano-materials sheet, which can be used as a gas sensor system. The Microcellulose sheet was treated with TEMPO (2,2,6,6-tetramethylpiperidine-1-oxyl) oxidation to prepare TEMPO-Oxidised Nanocellulose (TONC). However, nanocellulose is not electrically conductive which is necessary for energy device applications. Therefore, the TONC was blended with various concentration of Multi-Walled Carbon nanotubes (MWCNTs) to get conductive nanocomposites, which are oven dried at various temperatures to determine the effect on the conductivity. The optimum drying temperature was determined to be 60℃, with conductivity increasing with MWCNTS loading. The extent of the oxidised cellulose (TONC) was characterised by field emission scanning electron microscopy (FE-SEM) to determine the morphology and the Fourier-transform infrared spectroscopy (FT-IR) to identify the functional groups in the neat TONC paper. The SEM showed an increasing porosity with increasing oxidation time. The carboxyl groups also increase with increasing oxidation time.

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