Efficient direct sorbitol production from cellulose with Ru supported on highly microporous carbon/carbon nanotube hybrid catalysts

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Abstract (max. 250 words)

The direct conversion of cellulose into sorbitol, one of the platform molecules of highest potential, ~~by~~ using a low-cost catalyst that yields high productivity, is a current challenge. Ruthenium/glucose-derived carbons with tailored textural and chemical properties were prepared by combining two different strategies: activation and addition of carbon nanotubes (CNT) to obtain a hybrid carbon material. Accordingly, different carbon supports with different surface areas were prepared by hydrothermal polymerization of glucose and subsequent carbonization at 700 ºC under N_2 for 2 h (CG and CG-CNT) or subsequent physical activation at 900 ºC under CO_2 atmosphere for 2, 4 and 6 h (AG and AG-CNT). Ruthenium monometallic catalysts were then prepared by incipient wetness impregnation of Ru (0.4 wt.%) on the carbon supports. The synthesized catalysts were characterized by different techniques and then tested in the direct conversion of cellulose. The yield of sorbitol was improved due to the high microporosity and low acidity obtained by the appropriate combination of both preparation strategies: activation and addition of CNT. The total conversion of cellulose (100 %) and the highest yield of sorbitol (64.1 %) were achieved over a hybrid catalyst ($Ru/AG\text{-}CNT_{1200}$) within 3 h of reaction. Furthermore, this result surpasses that of the reference catalyst Ru/CNT, indicating that CNT can be successfully replaced by low-cost supports derived from biomass.