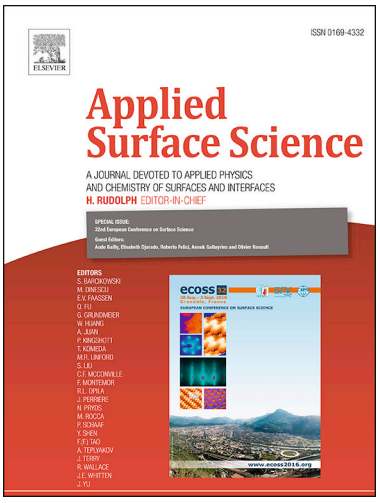

Full Length Article

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Effect of carbon support on the catalytic performance of Cu-based nanoparticles for oxidative carbonylation of methanol

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Abstract

Cu-based nanoparticles supported on three different carbon materials including: activated carbon (AC), ordered mesoporous carbon (OMC), and multiwalled carbon nanotubes (CNT) were prepared by ultrasonic assisted incipient-wetness impregnation and evaluated in oxidative carbonylation of methanol under atmosphere pressure. Samples were characterized by BET, XRD, TEM, H_2-TPR and XPS. The pore structure of carbon supports had significantly affected the location and dispersion of Cu species and the increased surface oxygenated groups promote Cu^{2+} reduced to (Cu^{+} + Cu^{0}). The Cu/OMC catalyst showed superior initial activity than Cu/AC and Cu/CNT catalysts because of smaller particle size of Cu species and moderate amounts of active species. The Cu/CNT catalyst was more stable than Cu/AC and Cu/OMC during the reaction process, and its deactivation is due to the oxidation of the active Cu_2O and Cu. Unlike Cu/CNT, the deactivation of Cu/OMC and Cu/AC was caused by the oxidation of the active Cu species (Cu_2O+Cu^{0}) and the increased particle size of Cu species.

Keywords: Cu-based catalysts, carbon support, oxidative carbonylation, SOG, pore structure, confinement effect, deactivation

1. Introduction

With the rapid growing production of methanol, the green transformation of