

Synthesis and characterization of alumina-carbon composite material for Transfer hydrogenation of Furfural to Furfuryl alcohol

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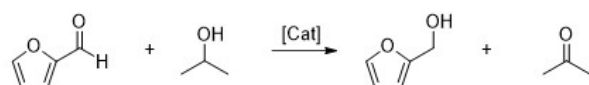
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Furfuryl alcohol is one of valuable furfural derivative that widely use in resin production, membranes, nanocomposite carbon, and dispersing agent [1]. FA can be obtained by the hydrogenation of furfural using H₂ gas in the presence of transition metal catalyst or through the catalytic transfer hydrogenation, the Meerwein-Ponndorf-Verley (MPV) reaction, in which molecular H₂ is replaced by alcohols that acts as a hydrogen donor. Although homogeneous Lewis acid such as Al(*i*-OPr)₃ is representative catalyst having great activity, MPV reaction also known to proceed in the presence of MgO, which are heterogeneous, inexpensive, and non-toxic as well as reusable with respect to homogeneous catalyst and transition metal-based catalyst. Basic site concentration on the surface of MgO was proposed as an important factor for the reaction [2].

In this study, we synthesized 3 kinds of alumina-carbon composite materials from Al(NO₃)₃ and surfactant Pluronic F127. By the ratio of aluminum precursor and surfactant at the preparation step, the amount of carbon and alumina has changed in the synthesized material. With increasing carbon content, the surface area and acid/base site concentration were increased. Using the synthesized materials as catalyst, MPV reaction of furfural to furfuryl alcohol was conducted in the presence of 2-propanol which acts as a H₂ donor. Results revealed catalyst having the highest carbon content showed the highest

activity among the prepared 3 kinds alumina-carbon composite material. The yield of furfuryl alcohol reached 95.6% with a selectivity of 97.2% at 130 °C for a 6 h reaction. This high selectivity could be ascribed to the presence of both acid and base site on the surface of the catalyst; the presence of acid site assumed to prevent the formation side product, which are synthesized by the reaction of furfural and acetone in the presence of base catalyst. However, gradual catalyst deactivation was observed during the reuse of the catalyst due to the leaching of active component from the catalyst.



Scheme 1. MPV reaction between furfural and 2-propanol.

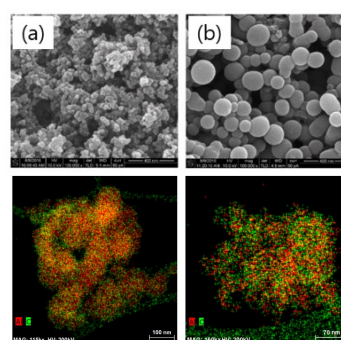


Fig. 1. SEM and TEM-EDX images of the catalyst.

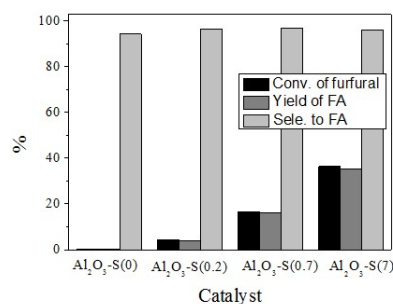


Fig. 2. Catalytic activities of various Al₂O₃-carbon composite catalysts.

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