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Influence of preparation parameters of γ-Al_2O_3 catalysts on its performance in methanol dehydration to dimethyl ether

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A series of γ-Al_2O_3 catalysts were prepared by precipitation of $Al(OH)_3$ from aluminum nitrate solutions, using NaOH as precipitating agent, followed by filtering and calcination at 500 °C. The resulting powder was formed as extrudates and tablets prior to performance test. The catalyst were tested in a fixed-bed reactor for dehydration of methanol to dimethyl ether (DME), an alternative and environmental benign fuel and chemical [1]. The effect of preparation conditions such as NaOH concentration (1-4 M) and forming on catalyst performance were examined.

The results showed that higher NaOH concentrations increased the surface area (and thus catalytic activity) of the samples (Fig. 1a) due to increased supersaturation [2]. A higher NaOH concentration is of economic benefit as it reduces the size of precipitation reactor. Above 270°C the reaction was equilibrium limited, and because of a high DME selectivity (≈100%) for all samples, this temperature is the optimum one in terms of DME yield. When formed as pellets, the extrudated sample showed higher conversion compared to tableted sample, due to more reduction of pore volume in the latter as a result of much higher pressure applied. The results were compared with a commercial sample and a higher yield was observed for the extrudate sample (Fig. 1b).

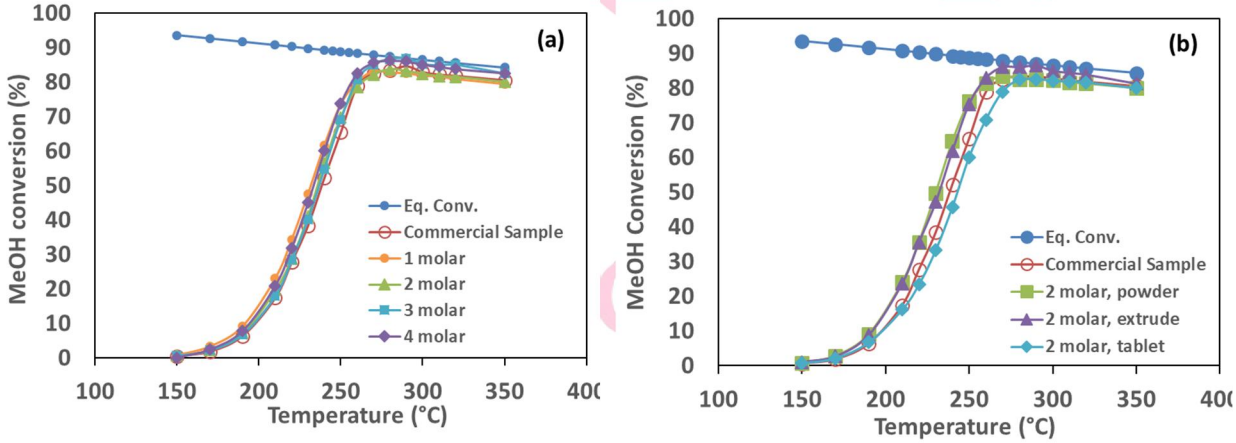


Fig. 1. Comparison of the performance of (a) powder, (b) shaped catalysts versus temperature.

Keywords: Methanol dehydration**,** dimethyl ether, γ-Al_2O_3 Catalyst, precipitation, catalyst forming

References

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