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Supplementary Materials

A Promising Catalyst for the Dehydrogenation of Perhydro-Dibenzyltoluene: Pt/Al_2O_3 Prepared by Supercritical CO_2 Deposition

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Abstract: Pt/Al_2O_3 catalysts prepared via supercritical deposition (SCD), with supercritical CO_2, wet impregnation (WI) methods and a selected benchmark catalyst, were evaluated for the dehydrogenation of perhydro-dibenzyltoluene (H18-DBT) at 300 °C in a batch reactor. After ten dehydrogenation runs, the average performance of the catalyst prepared using SCD was the highest compared to the benchmark and WI-prepared catalysts. The pre-treatment of the catalysts with the product (dibenzyltoluene) indicated that the deactivation observed is mainly due to the adsorbed H0-DBT blocking the active sites for the reactant (H18-DBT). Furthermore, the SCD method afforded a catalyst with a higher dispersion of smaller sized Pt particles, thus improving catalytic performance towards the dehydrogenation of H18-DBT. The particle diameters of the SCD- and WI-prepared catalysts varied in the ranges of 0.6–2.2 nm and 0.8–3.4 nm and had average particle sizes of 1.1 nm and 1.7 nm, respectively. Energy dispersive X-ray spectroscopy analysis of the catalysts after ten dehydrogenation runs revealed the presence of carbon. In this study, improved catalyst performance led to the production of more liquid-based by-products and carbon material compared to catalysts with low catalytic performance.

Keywords: supercritical deposition; wet impregnation; supercritical CO_2; liquid organic hydrogen carriers; dibenzyltoluene; dehydrogenation

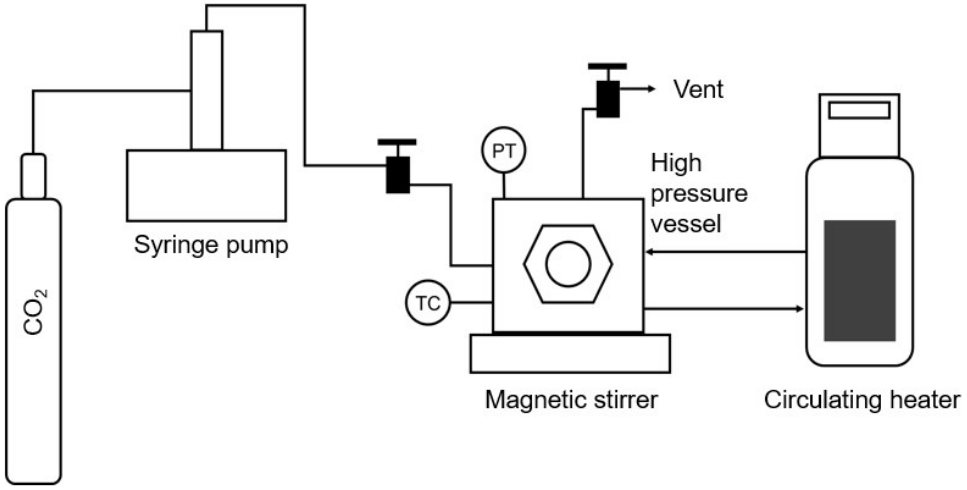

Figure S1. Schematic representation of the experimental set-up used for supercritical deposition.

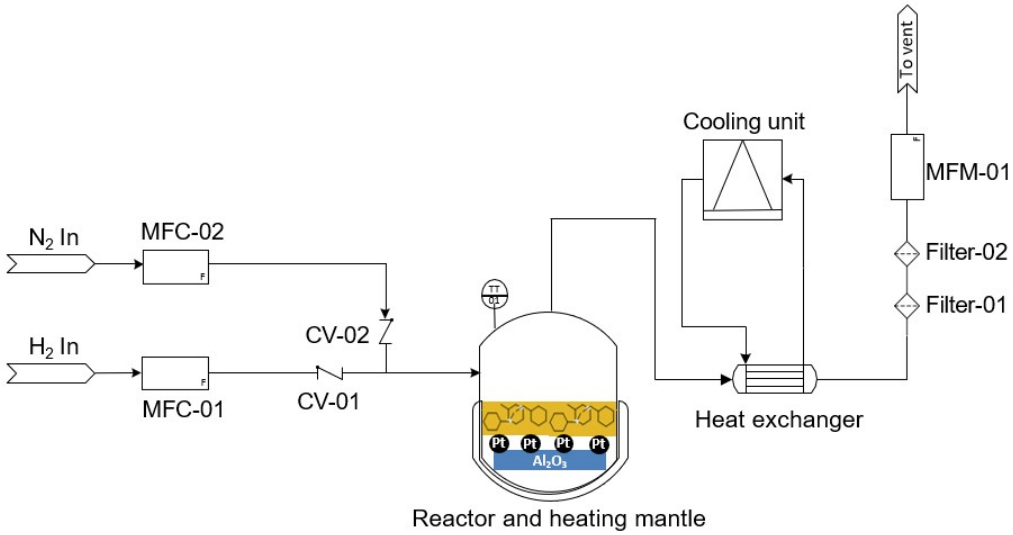

Figure S2. Schematic representation of the dehydrogenation set-up.