

Highly durable Pt-supported Nb₂O₅-SiO₂ aerogel catalysts in the aqueous-phase hydrodeoxygenation of 1-propanol

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Pt catalysts supported on crystalline Nb₂O₅·xH₂O, and amorphous SiO₂, Al₂O₃ and Nb₂O₅ aerogels were tested for their activity in the aqueous phase hydrodeoxygenation (APHDO) of 1-PrOH at 230 °C and 35 bar. The catalysts supported on amorphous SiO₂, Al₂O₃, Nb₂O₅ and crystalline niobic acid calcined at 500 °C showed low activities or deactivation. Under the APHDO condition, these supports experienced a structure transformation to crystalline quartz, boehmite and niobia TT phase. Thus, Pt/Nb₂O₅-Al₂O₃ and Pt/Nb₂O₅-SiO₂ aerogels were prepared and tested; however, the former catalyst experienced the crystallization into TT-Nb₂O₅ and boehmite under the reaction condition. In contrast, Pt/Nb₂O₅-SiO₂ aerogels with different Nb/(Nb+ Si) ratios were found to retain X-ray amorphous and porous structure. Also, their acid site densities were negligibly changed during the reaction. In terms of the catalytic performance, Pt/Nb₂O₅-SiO₂ aerogel catalysts exhibited the similar conversion around 50% up to 24 h and the molar propane/ethane ratio increased to about 1.0 with the acid site density.