STUDY OF 1.8 NM Pt NANOPARTICLES ANCHORED ON DIFFERENT AMORPHOUS SILICA SUPPORTS IN ETHANOL DECOMPOSITION REACTION

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Abstract

1.8 nm Pt nanoparticles with narrow size distribution were anchored on mostly identical, amorphous silica supports (SBA-15 [1], MCF-17 [2], Silica Foam [3]) and were tested in ethanol decomposition reactions at < 573 K. The reaction on the Pt/SF (0.117 molecules·site^{-1}·s^{-1}) was ~2 times faster compared to Pt/MCF-17 (0.055 molecules·site^{-1}·s^{-1}) and Pt/SBA-15 (0.063 molecules·site^{-1}·s^{-1}) at 573 K. In the case of Pt/SBA-15, selectivity towards acetaldehyde was ~4

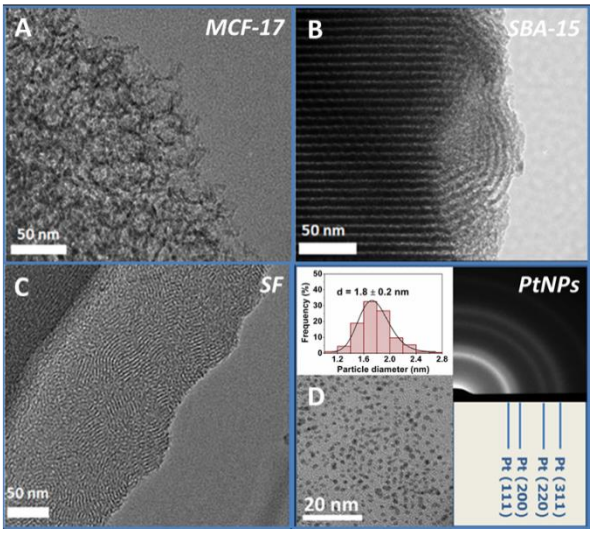

Fig. 1. Typical TEM images of MCF-17 (A), SBA-15 (B) and SF (C) silica supports as well as 1.8±0.2 nm metallic Pt nanoparticles with narrow size distribution (D).

times higher (68%) compared to the Pt/MCF-17 (18%) and Pt/SF (16%) catalysts. In the case of Pt/MCF-17 and Pt/SF, the methane to acetaldehyde ratio was 0.27 and 0.24, respectively, while it was ~ 10 times higher (1.97) for Pt/SBA-15 catalyst. The ethene selectivity was ~2 times higher

in the case of Pt/MCF-17 (0.99%) and Pt/SF (0.93%) compared to Pt/SBA-15 (0.41%). Pt/MCF-17 and Pt/SBA-15 produces ~ 50% more hydrogen (~27%) compared to Pt/SF catalyst (21 %). Small Angle X-ray Scattering (SAXS) and Transmission Electron Microscopy (TEM) studies showed striking differences in the porosity, pore- and mesostructure, sintering and Pt-SiO_2 interface altering effect of the silica supports as well as the Pt nanoparticles decorated catalysts which may have significant effect on the catalytic activity.

References

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