Performance of a Si-modified Pd-La/SiO_2 catalyst for the selective hydrogenation of acetylene

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A Pd-La/SiO_2 catalyst, containing La_2O_3 as a promoter for improving the selectivity of the catalyst for ethylene production in acetylene hydrogenation, was additionally modified with Si added by a chemical vapor deposition (CVD) method. The role of the added Si species was to lower the temperature required for reducing the air-oxidized, Pd-La/SiO_2 catalyst, which is necessary for the catalyst to resume the initial high ethylene selectivity. The Si-modified catalyst exhibited high ethylene selectivity when the air-oxidized catalyst was reduced at relatively low temperatures, e.g., 300°C, while the catalyst containing no Si had to be reduced at high temperatures, e.g., 500°C, to resume the initial ethylene selectivity. This was because the added Si species suppressed the La_2O_3 promoter particles, which were located on the Pd surface after reduction, from migrating back to the interface of the Pd particles and the SiO_2 support when the catalyst was oxidized in air. The anchoring role of the Si species, which were introduced exclusively on the Pd surface by a CVD method, was confirmed as the catalyst was characterized by H_2 chemisorption, infrared observation of adsorbed CO, XPS, and the temperature-programmed desorption of ethylene.