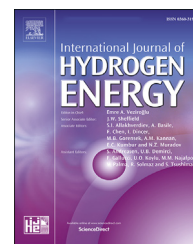


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Study on the role of Pt and Pd in Pt–Pd/TiO₂ bimetallic catalyst for H₂ oxidation at room temperature

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HIGHLIGHTS

- Pt played a role in highly dispersing Pt–Pd active metal particle due to the SMSI effect.
- As excellent reaction activity was shown with an increased ratio of Pd⁰/Pd_{Total}.
- The dissociative hydrogen adsorption proceeded in metallic Pd.

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ABSTRACT

The hydrogen safety issue is spotlighted as the hydrogen process is extended. For this reason, we studied catalysts for H₂ oxidation at room temperature to ensure hydrogen safety. Catalysts were prepared by different preparation methods and compared to evaluate the role of Pt and Pd in Pt–Pd/TiO₂ catalysts. The catalytic activity was significantly enhanced when activity metal size was small and it was exposed to catalyst surface to a high Pd ratio. For the 0.1%Pt-0.9%Pd/TiO₂ catalyst, high hydrogen conversion of 90% was obtained under the condition of 0.5% hydrogen injection. To understand the correlation between activity and characteristics of catalyst, the physicochemical characteristics of the various catalysts were investigated by X-ray photoelectron spectroscopy (XPS), temperature-programmed oxidation and reduction (TPOR) and Field Emission-Transmission Electron Microscope (FE-TEM) analysis. From these analysis, it was found that Pt served the role of highly dispersion of active metal (Pt–Pd) and as with increasing Pd ratio of active metal, hydrogen activity was increased, which indicates that hydrogen oxidation had proceeded on the Pd site. Finally, the valence state of the Pd influenced hydrogen oxidation activity of Pt–Pd/TiO₂, which increased with increasing ratio of Pd⁰/Pd_{Total}.

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