One-step preparation of thermally stable, silica-coated platinum/graphene composite

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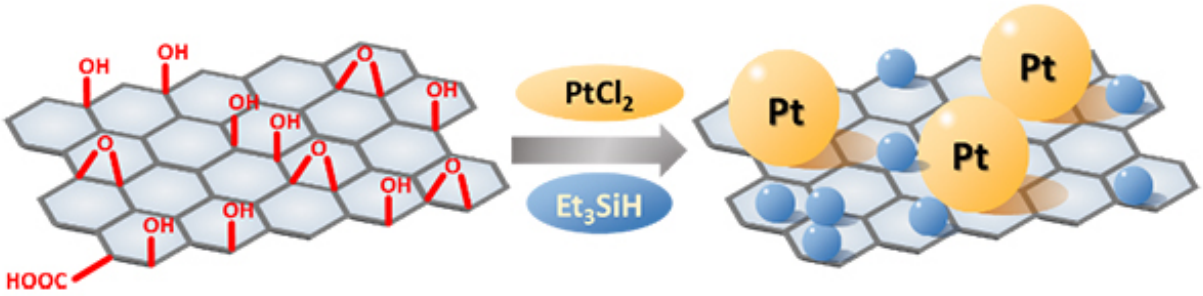

Figure 1: One-step preparation of silica-coated Pt/G composite.

Graphene-supported noble metal (Metal/G) composites are used as catalysts in organic synthesis, fuel cells, super capacitors, solar cells, and sensors. However, Metal/G composites react readily with oxygen to eliminate gaseous carbon oxides upon heating. Therefore, the development of thermally durable Metal/G is of great importance.

Yuta Nishina at Okayama University and co-workers focused on the development of a one-pot synthesis of silica-coated platium/graphene (Pt/G) composites with high thermal durability. To achieve this, hydrosilane was used as dual-role reagent for Pt nanoparticle formation and silica coating on the graphene (Figure 1).

The thermal resistance of the Pt/G composite was evaluated by a catalytic methane oxidation reaction at 400 °C. Compared with commercially-available Pt/carbon composite, whose catalytic activity decreased significantly after 40 min, the silica-coated Pt/G maintained its activity for more than 2 hours. The Pt/G prepared without hydrosilane did not show high activity at any point (Figure 2).

The recovered catalysts were analyzed, and the team found that almost all the carbon atoms in the commercial Pt/carbon composite disappeared. They also observed the aggregation of Pt particles. On the other hand, silica-coated Pt/G composite maintained its structure throughout (Figure 3).

The silica coating strategy should be applicable not only for Pt, but also for other noble metals. The prolonged stability of Metal/G composite will help to reduce global noble metal consumption.

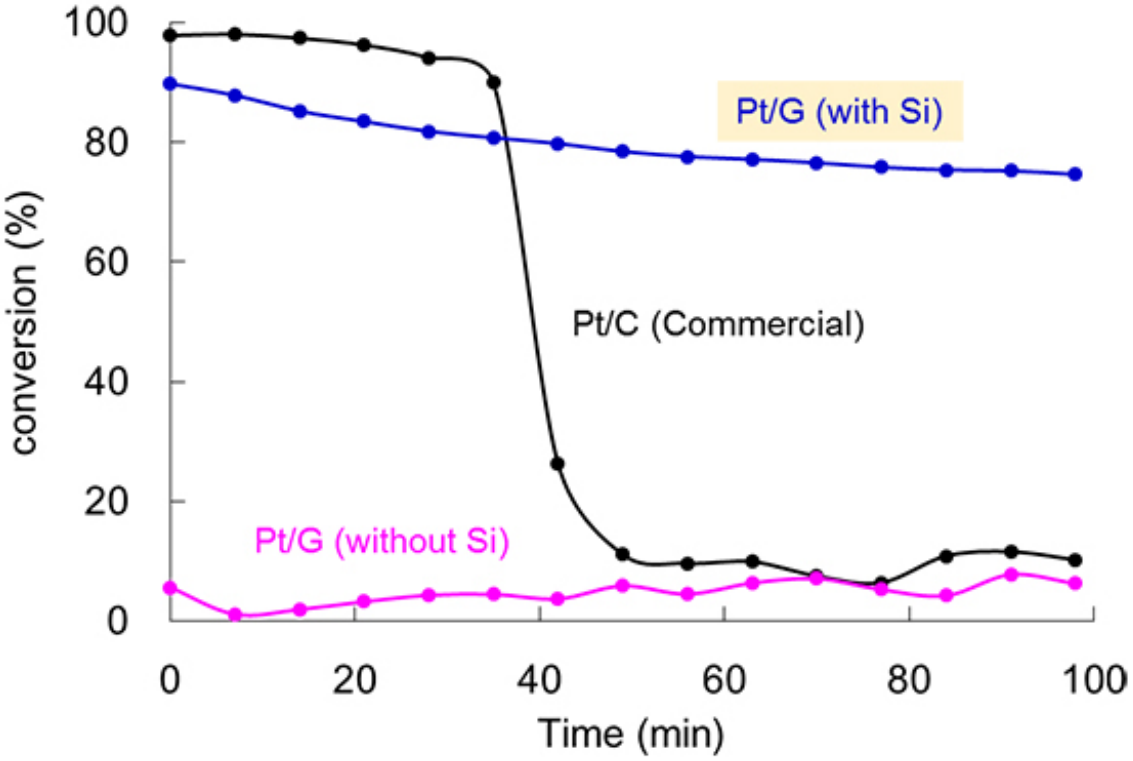

Figure 2: Evaluation of catalytic activity in methane oxidation at 400 °C.

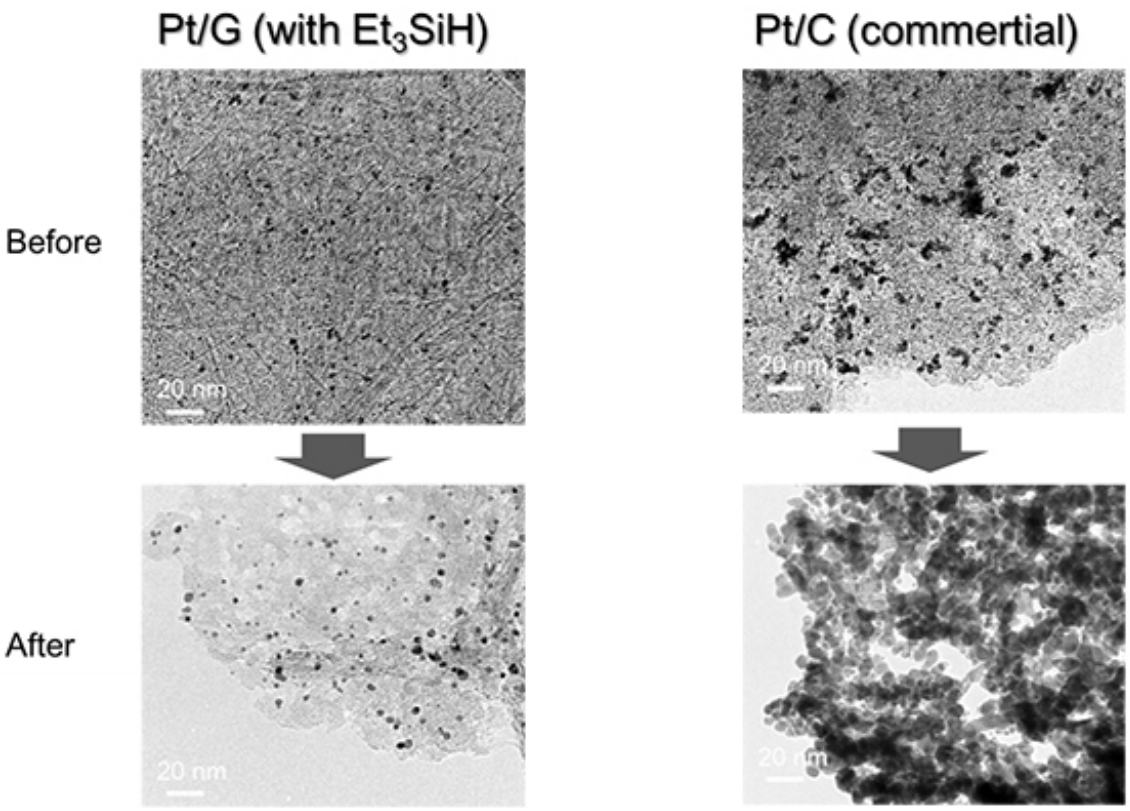

Figure 3: Observation of Pt/G and Pt/C before and after the methane oxidation by Transmission Electron Microscope.

More information: "Highly durable carbon-supported Pt catalysts prepared by hydrosilane-assisted nanoparticle deposition and surface functionalization." *Chem. Commun.*, 2015,51, 5883-5886 DOI: 10.1039/C4CC10298C

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