

Observation of the Ultrafine Platinum Particles over an Active Carbon Catalyst Support with a High-Resolution Scanning Electron Microscope

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Ultrafine platinum particles larger than ca. 2 nm in diameter over a powdery active carbon catalyst support have clearly been observed with a high-resolution scanning electron microscope.

For the development of supported metal catalysts, characterization of the dispersed metal particles over the supporting materials is indispensable. Although transmission electron microscopy (TEM)<sup>1)</sup> and scanning tunneling microscopy<sup>2)</sup> give important information about the structure of supported metal catalysts, they have limitations to reveal how and where the supported metal particles are embedded on the support. That is, the former can give only the transmitted images of supports and metal particles. This letter will present high-resolution scanning electron micrographs of the microstructure of active carbon (AC) support and the distribution state of the supported platinum particles over it.

A powdery active carbon-supported platinum catalyst, 5%-Pt/AC, was prepared by a usual impregnation method from an active carbon (made from a kind of wood) and an aqueous solution of hydrogen hexachloroplatinate. A high-resolution scanning electron microscope (HR-SEM) of Hitachi S-900 with 0.7 nm (at 30 kV) of resolution was adopted for the observation of the supported metal catalysts.

Figures 1 and 2 show HR-SEM images of a flat and a rough planes of the catalyst, respectively. Over the flat plane, one can observe both highly dispersed ultrafine platinum particles (ca. 3.5 nm in mean diam.) and some

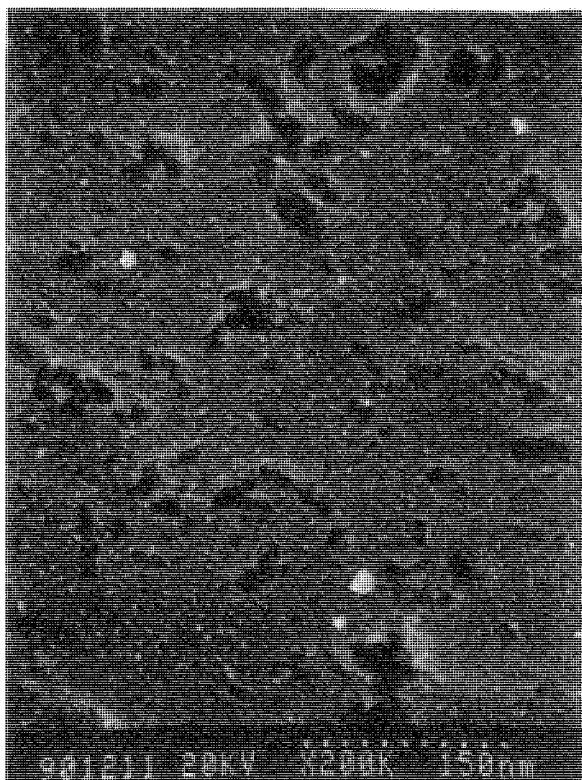


Fig. 1. A HR-SEM micrograph (secondary electron) of a flat part of the 5%-Pt/AC catalyst. [magnification: x200000]

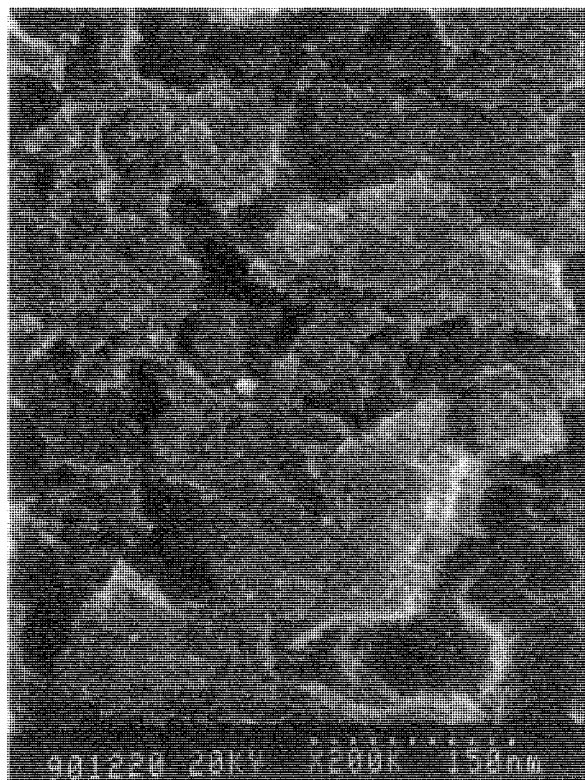


Fig. 2. A HR-SEM micrograph (secondary electron) of a rough part of the 5%-Pt/AC catalyst. [magnification: x200000]

larger clusters (10–20 nm in diam.) which were probably formed through coagulation of the ultrafine platinum particles. The mean diameter of the platinum particles over the rough plane is ca. 2.5 nm, which is somewhat smaller than that over the flat plane. In contrast to the TEM,<sup>1)</sup> this HR-SEM can simultaneously visualize the ultrafine platinum particles and the surface morphology of the support. If we adopted a TEM to the observation of the platinum particles, we could not succeed to distinguish the states of dispersion of platinum between on the flat plane and the rough plane. This HR-SEM will play important role in the investigations on the preparation, sintering process, or supporting materials of supported metal catalysts.

#### References

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