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Development of Quantitative Analysis Method to Determine TiO_2 Surface Area for Hydrogen Fuel Cell Catalyst †

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Abstract: Fuel cell has advantages in high efficiency and low pollution. Since a traditional cathode catalyst Pt/C has drawbacks in cost and durability, new types of TiO_2/C catalysts have been developed. However, there is no suitable quantitative method to obtain the TiO_2 surface area of these catalysts. To determine the surface area of TiO_2 on the TiO_2/C catalysts, we planned to find molecules that selectively adsorb on the TiO_2 surface but not on the carbon surface. Various TiO_2 and carbon samples were immersed in solutions of candidate organic molecules for quantitative adsorption analyses by using UV-Vis measurements. It was found that tiron has a high amount of adsorption on the TiO_2 surface, whereas only a low amount of adsorption was found on the carbon surface. The ratio of the absorbed amount of tiron to the surface area of TiO_2 was found to be almost constant over four TiO_2 samples of different crystal structures (rutile and anatase) and particle sizes (30 and 100 nm), which guarantees the validity of the present method as a quantitative analysis method to determine TiO_2 surface area. The analysis method is expected to contribute to the further development of metal oxide fuel cell catalysts.

Keywords: hydrogen fuel cell; catalyst; surface area; adsorption.

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Conflicts of Interest

The authors declare no conflict of interest. Lei Shang collected and analyzed the experimental data. Kenji Hara decided to publish the results. Both of them were involved in the design of the study, interpretation of data, and writing of the manuscript.