

Synthesis and Adsorption Properties of Nitrosocompounds on Titanium Dioxides †

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Abstract: The development of new catalysts is one of the most significant factors to realize the global industrialization of the fuel cell. Some metal oxides have been reported to show high durability and catalytic activity in polymer electrolyte fuel cells. However, methods to clarify the adsorption properties of oxygen molecules on the metal oxide catalysts have not been established, limiting further development of the catalysts. This study aims to establish methods to quantify the adsorption sites of oxygen molecules and reveal the adsorption structures by utilization of organic probe molecules. Nitroso compounds were selected as candidates for such probe molecules. Six nitroso benzene derivatives with various substituents were thus synthesized, and their adsorption experiments on metal oxides such as TiO₂ were carried out. For example, various TiO₂ samples of different crystal structures and particle sizes were used for these experiments, which shows that the adsorption properties of the probe molecules depend on the crystal structure and surface area of TiO₂. It is expected that more studies on the adsorption of organic molecules on metal oxides will strengthen the present method as a useful measure for the analysis and development of metal oxide fuel cell catalysts.

Keywords: oxygen reduction reaction; polymer electrolyte fuel cells; fuel cells catalyst; adsorption; nitroso compounds; titanium dioxide.

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Conflicts of Interest

The authors declare no conflict of interest. Masaya Kimura 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.