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3P31 - Aggregation inhibition of nanoparticle dispersion by nonthermal plasma irradiation

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The nonthermal equilibrium plasma has a high chemical reactivity and a characteristic that the temperature of the ion and the neutral particle is relatively low. Utilizing these features, many applications have been studied in the environmental field such as electrostatic precipitator, ozone generation, exhaust gas treatment, removal of volatile organic components, etc. In recent years, researches directed toward application to medical fields such as sterilization, dental treatment, and wound healing are actively conducted.
Nanoparticles have received much attention in recent years due to its remarkable properties, which offer important economic benefits and has been used in diverse applications. However, their property gradually decays because of aggregation, which means that adhesion between nanoparticles. To maintain high performance of nanoparticles in liquid requires a technique which maintains dispersion. Examples of conventional dispersion techniques include a bead mill, an ultrasonic homogenizer, a dispersant, and so on. Thus, numbers of equipment are required. Due to the disadvantages of conventional dispersion technologies, research on new dispersion technology has been conducted to solve these problems.
In this study, ZrO2 and ZnO were used for the target nanoparticles. ZrO2 is positively charged in solution. Conversely, ZnO is negatively charged in solution. The experimental results show that aggregation of ZrO2 nanoparticle dispersion was suppressed by irradiating non-thermal equilibrium plasma. The dispersion lifetime of ZrO2 could be extend its lifetime, but not in case of ZnO. The plasma irradiation increased the H2O2 concentration in the liquid. These results suggest that OH radicals may affect the surface hydroxyl group of ZrO2 to change the charged state.

Poster Board

Author: Mr SUENAGA, Katsushi (Graduate School of Science and Technology, Kumamoto University, Japan)

Co-authors: Mr HYODO, Ayumu (Graduate School of Science and Technology, Kumamoto University, Japan); Mr KAWAMURA, Yuta (Graduate School of Science and Technology, Kumamoto University, Japan); Prof. WANG, Douyan (Institute of Pulsed Power Science, Kumamoto University, Japan); Prof. NAMIHIRA, Takao (Institute of Pulsed Power Science, Kumamoto University, Japan)

Presenter: Mr SUENAGA, Katsushi (Graduate School of Science and Technology, Kumamoto University, Japan)

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