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ソリューションプラズマによる電極上での物理的・化学的反応の解析

Analysis on Physical and Chemical Reaction on the Electrodes in Solution Plasma

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In recent years, solution plasma has been developed due to their various applications such as waste water treatment, synthesis and decomposition of materials. Solution plasma also can generate high active species such as oxygen, hydrogen, hydroxyl ion and electron in case of water. In addition, over current was flown by breakdown of material. Solution plasma applications were closely related by controlling of those conditions. Nanoparticles can be synthesized using not only reduction [1] but also sputter process [2]. We can understand that chemical reaction is key point in case of reduction and physical reaction is key point in case of sputter. However, those reactions were occurred at the same time. These processes also led to consume the electrode, which make solution plasma unstable.

In this research, we aimed to reveal the efficiency between physical and chemical reaction and we control the reaction on the electrodes to keep forming stable solution plasma for a long time. It is important to improve productivity of material synthesis in solution plasma.The spectrum of solution plasma was recorded using an Optical Emission Spectroscope (USB4000, Ocean Optics, USA). The I-V waveform was measured using an oscilloscope (DLM 2022, Yokogawa, Japan) in order to evaluate plasma condition. In addition, water temperature was observed using an IR camera (InfraRed, NEC Avio, Japan) with an automatic recording interval of 5 second. Ratio of energy was calculated using excitation intensity, I-V curve and temperature. In addition, erosion of tungsten needle electrodes was measured using loss of length and weight.

Figure 1showed weight and length loss velocity as increase primary voltage. Primary voltage is voltage of outgoing level from power generator (MPS-R06K01C-WP1-6CH, Kurita, Japan). Stable plasma condition was existed. In addition, erosion status can be analyzed using determined shape of electrodes and weight.

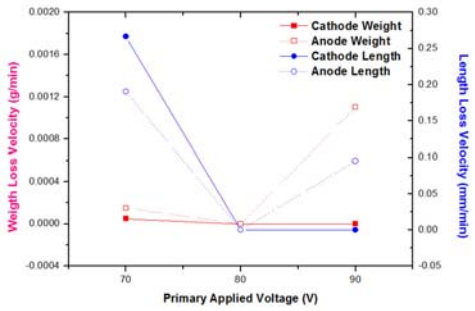

Figure 1. Loss velocity of electrodes by solution plasma.

Reference

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[2] X. Hu, S. P. Cho, O. Takai, N. Saito, Crystal Growth Design, 2011, 12, 119–123

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