Numerical Study on Tempo-Spatially Varying Thermofluid Field in Tandem Type of Modulated Induction Thermal Plasmas -Effect of Lower Coil Current Modulation-

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We have developed a modulated inductively coupled thermal plasma (ICTP), which is established with amplitude modulated coil current for materials processing. Such an amplitude modulation in the coil current can provide temporally-varying high-temperaturefield in the ICTP. This modulated ICTP is much effective for nanoparticles synthesis because it offers high temperature field for feedstock evaporation and lower temperature field for quenching feedstock vapor. To obtain further not only temporally but also spatially-varying field, we developed a tandem type of modulated ICTP. This tandem type of ICTP has two different coils in one torch; an upper coil and a lower coil. In addition, the amplitude modulation in two coilcurrent for the tandem ICTP can produce a further tempo-spatially varying thermofluid field in the torch.

In this study, we developed a numerical model to predict tempo-spatial variation in thermofluid field in a tandem type of modulated ICTP. The developed model solves the conservation equations of mass, momentum and energy, taking into account electro-magnetic fields from two coil current. To understand fundamental characteristic of tandem type of modulated ICTP, the influence of current modulation for the lower coil was investigated. Results showed an unique tempo-spatial thermofluid field in the tandem modulated ICTP.