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Influence of quenching gas injection on the temperature field in pulse-modulated induction thermal plasma for large scale nanopowder synthesis[1] YASUNORI TANAKA, WEIXUAN GUO, NAOTO KODAMA, KENTARO KITA, YOSHIHIKO UESUGI, TATSUO ISHIJIMA, Kanazawa University, SHU WATANABE, KEITARO NAKAMURA, Nisshin Seifun Group Inc. — We have so far developed a unique and original method for a large-scale nanopowder synthesis method using pulse-modulated induction thermal plasmas with time-controlled feedstock feeding (PMITP-TCFF). The PMITP is sustained by the coil current modulated into a rectangular waveform. Such the current modulation produces an extremely high-temperature thermal plasma in on-time, and in off-time relatively low-temperature thermal plasma. In PMITP-TCFF method, feedstock powder is intermittently injected to the PMITP synchronously during only on-time for its efficient and complete evaporation. That evaporated materials are rapidly cooled down to promote nucleation of nanoparticles during off-time. This report deals with a numerical approach on influence of quenching gas injection on the temperature field in the PMITP. The thermofluid model for the PMITP was developed on the assumption of local thermodynamic equilibrium (LTE). This model accounted for the pulse-modulation of the coil current and the quenching gas injection. It was found that the quenching gas injection works to increase the PMITP temperature inside the plasma torch during on-time, and then to decrease it effectively in the reaction chamber.

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