Abstract Submitted
for the GEC19 Meeting of
The American Physical Society

Numerical Analysis of Pulsed TIG Arc Welding under Consideration of Thermal and Chemical Non-Equilibrium YUSUKE NEMOTO, YUJI KOMAI, ZHENWEI REN, YOSHIFUMI MAEDA, TORU IWAO, Tokyo City University — TIG arc welding is widely used as a technology for joining metal materials. However, the current is limited in order to prevent wear of tungsten used for the cathode. Thus, the weld defects such as insufficient melting caused by insufficient heat input occurs. The pulsed TIG welding is used in order to prevent the weld defects. The pulsed TIG welding can obtain a deep penetration depth of the weld pool with changing the current into a pulse. However, the physical phenomena of pulsed TIG welding are not elucidated. Especially, it has not been reported the study about the thermal and chemical non-equilibrium. The thermal non-equilibrium becomes remarkable with changing the current rapidly. Moreover, the electron number density decreases with consideration of the reaction rate in comparison with the local thermal equilibrium. In this paper, the numerical analysis of pulsed TIG arc welding under consideration of thermal and chemical non-equilibrium using 3-D electromagnetic thermal fluid simulation is investigated. As a result, it was elucidated that the electron temperature was dominated by diffusion phenomenon. On the other hand, the heavy particle temperature was dominated by convection phenomenon.

Yusuke Nemoto
Tokyo City University

Date submitted: 30 May 2019 Electronic form version 1.4