Abstract Submitted
for the GEC10 Meeting of
The American Physical Society

Estimations of electron temperature and electron density in argon-based reactive plasmas based on diode laser absorption spectroscopy KOICHI SASAKI, Hokkaido University, RYOTA ASAOKA, Nagoya University — A metrological method which is suitable for monitoring plasma processing tools in factories is significantly required from the industrial point of view. In this work, we propose a method for estimating electron temperature and electron density in argon-based reactive plasmas. This method is based on the measurements of the densities of two metastable states of argon ($4s[3/2]_2^o$ and $4s'[1/2]_0^o$) by diode laser absorption spectroscopy. The densities of the two metastable states obtained experimentally are compared with those evaluated by using a population- kinetics model, where the production and loss rates of the metastable states are given as functions of the electron density and the electron temperature. We demonstrated this method in an inductively-coupled N_2/Ar mixture plasma. As a result, rough agreement between the proposed method and a Langmuir probe measurement was obtained. This method would be applicable to in-situ monitoring of plasma processing tools in factories because of the low cost, the small footprint, and the maintenance-free operation of a diode laser.

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Date submitted: 01 Jun 2010 Electronic form version 1.4