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Plasma Characteristics on Plasma Induced Nanoparticle-Film Fabrication

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Extended Abstract

Plasma induced nano-particle fabrication method on the metallic thin film has been proposed. In the method, the plasma parameters, such as plasma density, plasma uniformity, and ion energy play a central role on size and uniformity of the nano-particle thin film. In this work, plasma parameters are studied in conventional inductively coupled plasma (ICP) reactor with radio-frequency (RF) bias. When the ICP power increases, the plasma density is abruptly increased due to a capacitive to an inductive mode transition. At the capacitive mode, an additional RF bias results in an increase in the plasma density, while the plasma density is slightly decreased at the inductive mode of the ICP. This different characteristic can be understood by the power dissipation mode transition between ions at the sheath and electrons at the plasma bulk. At the inductive mode, the plasma uniformity and electron energy distribution are evolved through non-uniform power deposition and electron bounce resonance heating. Based on the plasma parameters obtained with various discharge conditions, a study on the nano-particle film fabrication is conducted, and correlation between the nano-particle formation and the plasma parameters are discussed in depth.