?Pressure Effect on Polycrystalline DiamondFilm Deposition using Modulated to Non-Modulated InductionThermal Plasmas

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The inductively coupled thermal plasma (ICTP) has someadvantages of their high enthalpy and high radical density without any impuritycontamination for materials processing. As a further effective radical source,we previously developed a modulated induction thermal plasma (M-ITP). ThisM-ITP is established by the amplitude-modulated coil current, offering atime-controlled temperature and chemical reaction field in the ICTP.

In this study, we investigated polycrystalline diamondfilm deposition by exposure of M-ITP at different pressures. Diamond hasattractive outstanding properties such as hardness, high thermal conductivity,wide band gap, chemical inertness, and is therefore expected to be applied forvarious fields from machining tools to power semiconductors. Pressure canaffect the M-ITP properties and the deposition rate. In addition, we attemptedto adopt a unique method “the time-series exposure of M-ITP and non-modulated ITP”for polycrystalline diamond film deposition. The M-ITP can promote diamondparticle nucleation on Si substrate in the first stage of deposition, although non-modulatedITP is more effective for diamond growth if thesubstrate surface is covered by diamond film. The deposited film on Si substrate was analyzed byFE-SEM and Raman spectroscopy. Results indicated that reduced pressure enhancedthe deposition rate of polycrystalline diamond film.