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Quadrupole Mass Spectrometric Studies on the Laser Ablation of Boron Nitride and Graphite Surfaces

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Quadrupole mass spectrometric studies were performed to elucidate the mechanism of laser ablation of boron nitride in high vacuum condition by Nd:YAG laser (266 nm) irradiation. By using time-of-flight quadrupole mass spectrometry, B^+ ions with most probable velocity of 34 eV were observed with ionizer off. The shifted Maxwell Boltzmann fit to the time-of-flight mass spectrum of B^+ ions was attempted. Only boron isotopes were found in the mass spectrum obtained by gated integration with ionizer off. With ionizer activated, nitrogens were found as molecules. By laser ablation of boron nitride, nitrogen atoms effuse out from the surface as molecules slowly compared to B^+ ions, which explains the nitrogen deficiency in the deposition of boron nitride thin films. By laser ablation of graphite, C^+, C_2^+, and C_3^+ were observed with trace amount of larger cluster ions. The relative ratio and kinetic energy distribution of the carbon ions were measured as a function of laser fluence. At laser fluences near 1 J/cm^2, most carbon ions were detected as C^+ and the C^+ ions with kinetic energy up to 100 eV were observed.