Analysis of Time-Resolved Laser Plasma Ablation using an Imaging Spectra Technique

http://www.firstlight.cn 2007-12-31

Pulsed laser deposition (PLD) is extensively employed for the growth of thin films. The laser-material interaction involves complex processes of heating, melting, vaporization, ejection of atoms, ions and molecules, shock waves, plasma initiation, expansion and deposition onto a substrate. The understanding of the spatial and temporal distribution of a plasma parameters in a laser-produced plasma is important to the control of thin film growth process. In this work we have studied the dynamics of laser ablated graphitic carbon plasma expanding into vacuum using a spectroscopic imaging suitable as an in situ & automated diagnostic sampling technique for PLD. Time-resolved spectra, that were also spatially resolved in one dimension along the axis of plasma expansion, were obtained using a time-gated intensified charge-coupled device (ICCD) coupled to a stigmatic Czerny-Turner spectrograph. Plasma parameters such as electron density, temperature and plume velocity expansion were extracted directly from the analysis of the C II (2s23d-2s24f) transition.

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