EUV/VUV Spectroscopic Diagnostics for Microplasmas

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Microplasmas are high density, dc or pulsed discharges produced in cavities having characteristic dimensions in the tens to hundreds of μm range. While emission spectroscopy is a powerful tool for their diagnostic, important plasma parameters such as electron density, temperature, energetic electron fraction and impurity content are often difficult to measure using visible light. Since the bulk microplasma emission can be expected to be in the EUV to VUV spectral range, we study the possibility of adapting XUV/VUV diagnostics developed within our magnetically confined fusion work, for use in microplasma research. For instance, a tool that could enable, with appropriate modeling, the characterization of the electron energy distribution function (EEDF) in dc microplasmas would be a transmission grating EUV/VUV 'radiometer' that measures the spectral distribution of the emitted power. Also a device based on 'multi-energy' filtered photodiodes, similar to that we developed for fast temperature diagnostic in tokamaks, could be used for EEDF characterization in pulsed microplasmas. In addition, the proposed diagnostics might enable new research directions, such as the study of fluctuations, or of localized electron beams. To benchmark the XUV emission models for microplasma application, we use a macroscopic reflex discharge, in which conventional diagnostics can be applied for reference measurements of the bulk density, temperature and non-thermal component.
