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In Situ Approaches for Diagnostics of Nanoparticles in Plasmas[1]

SHURIK YATOM, Princeton Plasma Physics Laboratory, ALEXANDROS GERAKIS, Princeton Plasma Physics Laboratory, Texas AM University, ALEXANDER KHRABRY, Princeton Plasma Physics Laboratory, JUNHWI BAK, University of Tokyo, HUNTER BELANGER, Rensselaer Polytechnic Institute, MICHAEL SHNEIDER, Princeton University, JAMES MITRANI, Princeton University, Lawrence Livermore National Laboratory, IGOR KAGANOVICH, ANDREI KHODAK, BRENTLEY STRATTON, VLAD VEKSELMAN, YEVGENY RAITSES, Princeton Plasma Physics Laboratory — Plasmas are widely used for synthesis of various nanomaterials. Plasma-mediated methods offer industrial scale of production while being less expensive and environmentally friendly compared to chemical and mechanical methods. They also hold a promise for controllable synthesis, due to the ability to control the plasma characteristics and plasma-induced chemistry. So far, the understanding of the interplay between the plasma and the synthesized products was dependent on the ex-situ analysis and recently a demand emerges for in-situ diagnostic techniques for characterizing the nanomaterials in the gas phase. We present three different techniques for measurement of nanoparticles. Coherent Raleigh Brillouin Scattering (CRBS) relies on scattering of photons from particles trapped in a laser interference pattern. Laser-induced incandescence (LII) technique interprets the cooling pattern from the particles heated by a laser, to obtain their sizes. Laser-induced breakdown spectroscopy (LIBS) detects nanostructures and diagnoses their chemical composition. We also show examples of their application in carbon arc.

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