Applying a laser-induced incandescence (LII) diagnostic to monitor nanoparticle synthesis in an atmospheric plasma, in situ

SHURIK YATOM, JAMES MITRANI, Princeton Plasma Physics Lab, YAO-WEN YEH, MIKHAIL SHNEIDER, Princeton University, BRENTLEY STRATTON, YEVGENY RAITSES, Princeton Plasma Physics Lab — A DC arc discharge with a consumed graphite anode is commonly used for synthesis of carbon nanoparticles, including carbon nanotubes (CNTs) and graphene flakes [1-3]. The graphite electrode is physically vaporized by high currents (20-60 A) in a buffer gas at 100-600 torr, leading to nanoparticle synthesis in a low temperature (>1 eV), plasma. Utilizing arc plasma synthesis technique has resulted in the synthesis of higher quality nanomaterials [3]. However, the formation of nanoparticles in arc discharge plasmas is poorly understood. A particularly interesting question is where in the arc the nanoparticles nucleate and grow. In our current work we show the results of studying the formation of carbon nanotubes in an arc discharge, in situ, using laser-induced incandescence (LII). The results of LII are discussed in combination with ex situ measurements of the synthesized nanoparticles and modeling, to provide an insight into the physics behind nanoparticle synthesis in plasma. 1. C. Journet et al. Nature 388, 756-8 (1997); 2. A. J. Fetterman et al. Carbon 46 1322-6 (2008); 3. M. Keidar et al. Phys. Plasmas 17, 057101 (2010);

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