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Controlled Particle Generation in an Inductively Coupled Plasma

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Carbon clusters with diameters in the range of 10 to 50 nm are produced by injecting pulses of acetylene into an inductively coupled plasma (ICP) from argon and helium. The injection causes an instability of the inductively coupled plasma, which becomes visible as an oscillation of the emission intensity. The frequency of this oscillation can be uniquely correlated to the particle diameter. Consequently, the measurement of the oscillation frequency represents a method to determine particle diameters in-situ. This particle driven instability of an inductive plasma is characterized by space and time resolved Langmuir probe measurements as well as by optical emission spectroscopy. These data indicate that the oscillation corresponds to the rotation of a localized plasmoid and a particle cloud around the symmetry axis of the reactor. The rotation is driven by the ion wind crossing the interface between the plasmoid and the particle cloud. The interplay of the particles with the performance of the inductive plasma is modelled using a hydrodynamic code.