Abstract Submitted
for the GEC13 Meeting of
The American Physical Society

Void dynamics in low-pressure acetylene RF plasmas[1] FERDINANDUS MARTINUS JOZEF HENRICUS VAN DE WETERING, SANDER NIJDAM, JOB BECKERS, GERARDUS MARIA WILHELMUS KROESEN, Eindhoven University of Technology, Department of Applied Physics, P.O. Box 513, 5600 MB Eindhoven, the Netherlands — In low-pressure acetylene plasmas, dust particles spontaneously form under certain conditions. This process occurs in a matter of seconds to minutes after igniting the plasma and results in a cloud of particulates up to micrometer sizes levitated in the plasma. We studied a capacitively coupled radio-frequency plasma under normal gravity conditions and constant flow of feed gas (argon and acetylene). After the dust cloud has been formed, an ellipsoid-shaped dust-free zone – called a void – develops and grows as a function of time. Concurrently, the dust particles grow in size. Peculiar dynamics of the void have been observed, where during its expansions it suddenly stops growing and even shrinks, to shortly thereafter resume its expansion. We infer this is induced by coagulation of a new batch of dust particles inside the void. The whole dust growth and void expansion/contraction is periodical and highly reproducible. Several techniques are used to gain information about the plasma dynamics. Microwave cavity resonance spectroscopy is used to determine the global electron density. Scattering of a vertical laser sheet is used to visualize the dust particle density. The electrical characteristics of the plasma are determined using a commercially available plasma impedance monitor.

[1]This work is supported by NanoNextNL, a micro and nanotechnology programme of the Dutch Government and 130 partners.

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Date submitted: 17 Jun 2013 Electronic form version 1.4