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Mass Spectrometric Measurements on a Nanodust forming Plasma

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Introducing reactive species into a plasma environment leads to the formation of ions, neutrals and radicals of its dissociated products. If some of these overcome a certain concentration nuclei can be formed in the gas volume. The growth from a nucleus to a nanoparticle is then dominated by different mechanisms.
Vice versa, the nanoparticles influence their own environment. During different stages of particle growth the plasma density and electron temperature vary which affects not only the density of ions but also the dissociation of the precursor and, thereby, the chemical composition of the process gas.
Therefore, the understanding of nanoparticle formation requires knowledge of chemical processes in the plasma. In this study particle synthesis from an acetylene containing CCRF-plasma was observed by means of mass spectrometry. Choosing the total gas pressure and acetylene admixture to argon allows to generate distinct particle growth cycles [1] with mono-disperse sizes of the particles, so that the growth process can be monitored in-situ.
Correlating the mass spectra with electrical measurements of the selfbias voltage in combination with former studies [2] makes it possible to link the spectra directly to a particle size. In this way the importance of different chemical species during nucleation, agglomeration and accretion will be discussed.
[1] M. Hundt et al., J. Appl. Phys. 109, 123305 (2011)
[2] A. M. Hinz et al., J. Phys. D: Appl. Phys. 48 055203 (2015)

Keywords
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