Microrods in a Gas Discharge Plasmas – Results of First Experiments under Microgravity

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In present experiment an ordering and dynamics of monodisperse nylon rods (D=10μm, L=300 μm) in DC and RF gas discharge plasmas under microgravity have been investigated. The experiments were performed on a board of special plain A-300 ZERO-G (NOVESPACE, France) during ESA Parabolic Flight Campaign #45 (October, 2006). Period of microgravity was ~22 sec. Experiments have been provided in a Π-shape glass tube with an inner diameter of 3 cm and a full length of 75 cm, which is equipped by two DC electrode (I_{DC}=1 mA) and RF inductor (82 MHz). Ordered rod structures were recorded in DC discharge with rod concentration of $0.4 \cdot 10^3 - 8 \cdot 10^3$ cm^{-3} and neon pressure range 25-50 Pa. The structures revealed orientationally ordered hexagonal structures. DC discharge was unstable at rod number density more then $8 \cdot 10^3$ cm^{-3}. Rod drift velocities in a permanent electric field were measured for the neon pressure range. Dust acoustic instability ($\nu \sim 0.4 \pm 0.1$ Hz, $\lambda \sim 1.1 \pm 0.4$ cm, $C_{DAW} \sim 0.5$ cm/s) in rod cloud was observed at neon pressure of 25 Pa and rod number density of 1500 cm^{-3}. Using the "low" frequency approximation of the linearized DAW dispersion relation and the rod drift velocity a rod electric charge had been estimated as $Z_R \sim 150000e$. To investigate rod ordering in RF inductive discharge they were transported by a gas flow in DC discharge. As soon as rods achieved RF(i) glow, the gas flow was stopped and DC discharge was switched off. RF(i) discharge was suppressed by the rods at its number density more then 500 cm^{-3}. As in the case with DC discharge, all the rods orientate along the ambipolar diffusion field of the RF(i) discharge.