Characterization of Al_2O_3 nanoparticle clouds in an rf discharge

H. Krüger[1], A. Melzer[1]

[1] *University of Greifswald, Greifswald, Germany*

Dusty plasmas with nanoparticles have attracted increased attention in the last few years. In comparison to the existing experimental setups with nanoparticles grown in the rf discharge, we present the insertion of industrial, nanoscaled Al_2O_3 dust with a gas jet injection setup. Beside the insertion, the characterization of the nanodusty plasma is of particular interest.

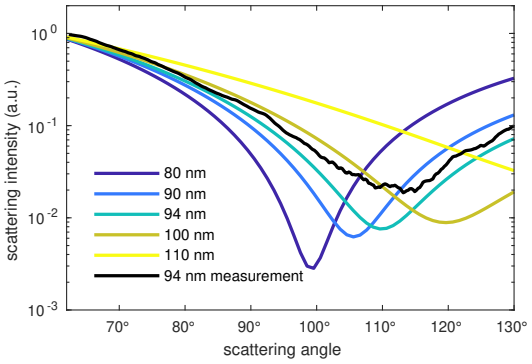

Figure 1: *Scattering intensities for different particle sizes of Al_2O_3 particles.*

The confined particles are being investigated in terms of size by a Mie scattering setup. The angular dependent scattering intensity of particles allows to determine their size, see Fig. 1. Using a telecentric lens, we are able to obtain the size distribution of the nanoparticle cloud, see Fig. 2a).

The density distribution has been measured with an absorption spectroscopy setup. Recording the transmission of light emitted by a white LED panel through the particle cloud gives the line integrated particle density. Under the assumption of a cylindrical symmetry of the cloud, an Abel inversion is performed to obtain the spatially resolved particle density, see Fig. 2b) [1].

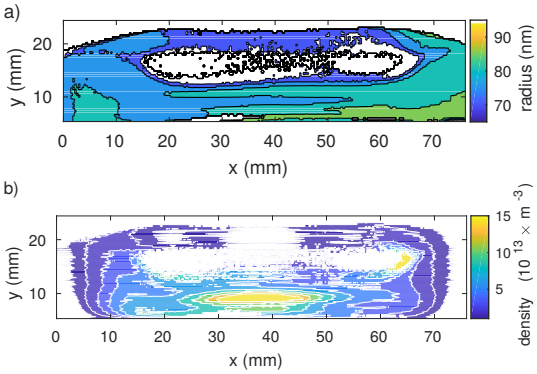

Figure 2: *a) Size distribution and b) density distribution of an alumina particle cloud.*

Furthermore, theoretical calculations predict a charge dependent shift of the absorption in the infrared spectral range of the particles [2]. A measurement of this shift could lead to a non-invasive measurement of the charge of the nanoparticles. Existing experiments have measured the absorption in-situ, but did not show a charge variation due to a low resolution of the FTIR spectrometer yet. Therefore, new experiments with a higher resolution have been carried out.

This work was financially supported by the DFG via SFB-TR24 Project A3 and ME 1534/8-1.

References

[1] H Krüger, C. Killer, S. Schütt and A. Melzer, Plasma Sources Sci. Technol. **27** 025004 (2018)

[2] R. L. Heinisch, F.X. Bronold and H. Fehske, Phys. Rev. Lett. **109**, 243903 (2012)