

Abstract Submitted
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Investigation of plasma densities in noble gas discharges by THz Time Domain Spectroscopy STEFFEN MARIUS MEIER, TSANKO VASKOV TSANKOV, DIRK LUGGENHÖLSCHER, UWE CZARNETZKI, Institute for Plasma and Atomic Physics, Ruhr-University Bochum, Germany — Terahertz Time Domain Spectroscopy (THz TDS) is a non-invasive diagnostic method using ultra-short (\sim ps) radiation pulses with a broad spectral width (\sim 0.1-5 THz) in the far-infrared region of the electromagnetic spectrum. Here this novel technique is applied to the determination of electron densities in low-temperature plasmas. The technical requirements will be introduced and advantages and challenges will be discussed. A new analysis method allows dealing with an inherent artefact resulting from the experimental technique. Application is made to ICP discharges in noble gases. The measurements are performed in a magnetic multi-pole ICP discharge at a filling gas pressure of 20 Pa. Densities up to $\approx 1 \cdot 10^{14} \text{ cm}^{-3}$ are obtained and a non-linear dependence on the power is observed for all noble gases. By comparison with an analytical model electron pressure and gas heating effects are identified. Measurements and model show good agreement suggesting that neutral gas depletion due to a very high electron pressure (up to 80% of the filling gas pressure) is the major reason for the observed trends.

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