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Absorption spectroscopy of radicals produced by atmospheric-pressure discharges

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Absorption spectroscopy utilising an optical cavity represents a technique frequently employed for the purpose of investigating particle concentration, particularly in the context of analysing gases and atmospheric conditions. However, its use for investigating phase interfaces, particularly in the context of plasma discharges, is less well studied. The utilisation of incoherent broadband light in this technique confers several advantages, including in situ analysis and detection of particles at low concentrations, thereby facilitating a more profound comprehension of the chemical-kinetic processes in plasmas. Recent investigations suggest the significant potential for the application of non-thermal plasmas, particularly. Consequently, the focus of our experimental endeavours is directed towards the air-plasma interface. The present experiments are focused on the use of a detector under development using absorption spectroscopy enhanced by an optical cavity with a broad-spectrum light source (so-called IBB-CEAS - Incoherent Broad Band Cavity Enhanced Absorption Spectroscopy) for in situ plasma analysis. The primary focus of our research endeavours pertains to the detection of NO_2 and NO_3 radicals, the meticulous monitoring of temporal changes in their concentrations during the discharge process, and the development of a chemical-kinetic model to facilitate a more profound comprehension of the experimental data. NO_2 and NO_3 are of particular significance in the domain of atmospheric chemistry, particularly during nocturnal periods. The detection of these substances in plasma discharge, in particular NO_3, is a challenging process due to their high reactivity and low concentration. Consequently, the primary focus of our laboratory is the detection of these specific radicals and the potential optimisation of plasma sources for NO_3 production, which represents a potential practical application of our detector.

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Authors: PASTIEROVIC, Filip (Department of Experimental Physics Faculty of Mathematics, Physics and Informatics Comenius University, Bratislava, Slovakia); Dr ČERMÁK, Peter (Department of Experimental Physics Faculty of Mathematics, Physics and Informatics Comenius University, Bratislava, Slovakia)

Co-author: Dr MANZOOR, Shamaila (Department of Experimental Physics Faculty of Mathematics, Physics and Informatics Comenius University, Bratislava, Slovakia)

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