

# Modelling of the influence of nitrogen impurities on low-pressure argon glow discharges

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## Introduction

Small amounts of molecular gases such as nitrogen can affect drastically the conditions present in an argon glow discharge. In glow discharge optical emission spectrometry (GD-OES) the changed conditions can manifest themselves in the altered sputtering rates and the modified relative intensities of emission lines, thereby significantly influencing the quantitative analysis [1,2]. Computer modelling can be very useful in revealing the underlying mechanisms responsible for these effects.

## Description of the model

Previously [3] we developed a computer model describing Ar/ N<sub>2</sub> glow discharges with 74 different chemical reactions between the plasma species including electrons, Ar atoms in the ground state and the 4s metastable levels, N<sub>2</sub> molecules in the ground state and in six different electronically excited levels, N atoms, Ar<sup>+</sup> ions, N<sup>+</sup>, N<sub>2</sub><sup>+</sup>, N<sub>3</sub><sup>+</sup> and N<sub>4</sub><sup>+</sup> ions. Now we have extended this model by taking the vibrational levels of the ground state N<sub>2</sub> molecules into account.

According to [4] we consider 68 vibrational levels. The additional processes involving the ground state molecules are the excitation and de-excitation of vibrational levels by electron impact collisions (e-V), the vibration-vibration (V-V) and the vibration-translation (V-T) energy exchange processes in N<sub>2</sub>-N<sub>2</sub> collisions and the V-T energy exchange processes in N<sub>2</sub>-N and N<sub>2</sub>-Ar collisions.

The electrons are simulated with a Monte Carlo model, whereas all other species are treated in a fluid model.

## Results

The results include the relative importance of the various processes in the discharge, the two-dimensional density profiles of several plasma species and the electron energy distribution function (EEDF) and the vibrational distribution function (VDF) at different positions of the discharge cell.

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