Spatial and temporal distribution of excited Cl atoms in a linear dielectric barrier discharge

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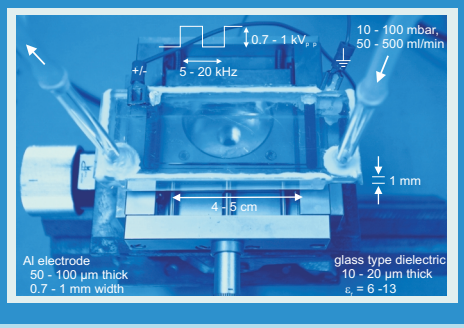
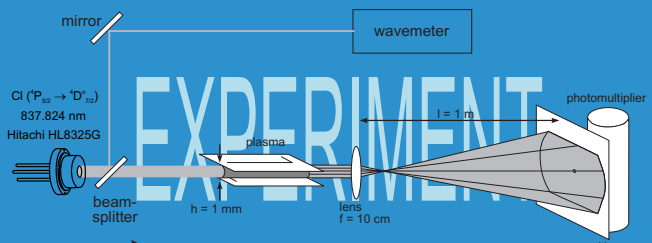
INTRODUCTION

- optical investigation of a dielectric barrier discharge (DBD) using diode laser absorption spectroscopy performed by a high spatial resolution arrangement
- study of the distribution of excited Cl atoms on the $^4P_{5/2}$ metastable level in Ar or He with 150 ppm CCl_2F_2
- results on the plasma parameters (electron density and gas temperature) temporally resolved
- improvement of the detection limit of halogenated hydrocarbons



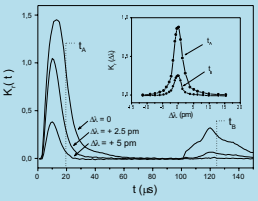
EXPERIMENT

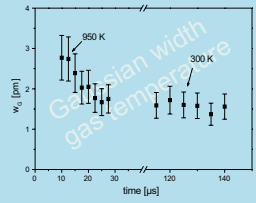


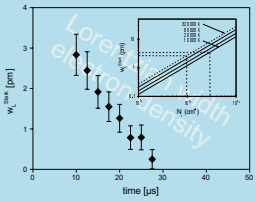
- **SPATIAL RESOLUTION** **50 µm**
- **TEMPORAL RESOLUTION** **100 ns**

PLASMA PARAMETERS

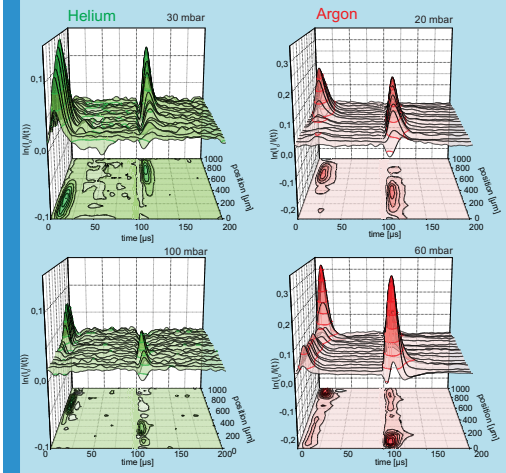
Ar^{res} $1s_4 \rightarrow 2p_6$
800.838 nm
Sharp LTO16MDO

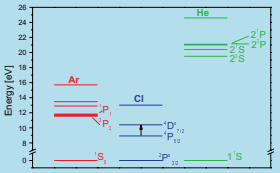






SPATIAL TEMPORAL DISTRIBUTION





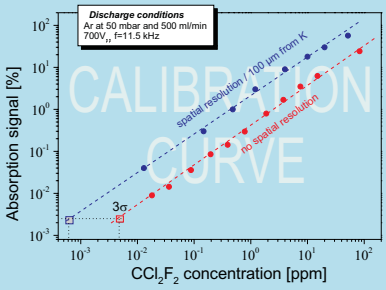
Higher population density in Ar than in He

- different electron density ($n^e_{He} < n^e_{Ar}$)
- collisional transfer between buffer gas and Cl excited atoms is more efficient in Ar

Different spatial position of maxima

- different electron mean free path ($\lambda^e_{He} > \lambda^e_{Ar}$)

CALIBRATION CURVE



CONCLUSIONS

- spatial (~50 µm) and temporal (~100 ns) evolution of excited Cl atoms
- different excitation processes in He and Ar proved by the behaviour of the excited Cl atoms
- improvement of the detection of CCl_2F_2 by Cl absorption measurements in the volume containing the maximum excited atoms density

DEDICATION

This paper is dedicated to the 70th birthday of Dr. Geavit Musa and his significant contribution to the field of plasma physics and technology in the last 40 years.