

CAMT Seminar

“The role of reactive oxygen and nitrogen species on the conversion of volatile organic compounds in a twin surface dielectric barrier discharge”

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Date: September 20, 2022 (Tuesday) 16:00-17:00

Location: Main Conference Room (1st floor), Bldg. A12

Center for Atomic and Molecular Technologies (CAMT)

(A12 棟 1 階会議室) & Webex Link (hybrid)

Abstract

A twin surface dielectric barrier discharge (SDBD), specially designed for the conversion of VOCs in synthetic air, has been previously studied regarding its fundamental plasma parameters, power efficiency, gas phase chemistry, gas dynamics, and conversion of frequently used hydrocarbons with and without catalyst [1-3]. However, the complex interaction of the different media and the underlying conversion mechanism is not yet fully understood.

Here, techniques such as flame ionization detectors and gas chromatography-mass spectrometry are used to gain insight into the occurring gas-phase chemistry, possible reaction pathways, and advantages of the presented discharge over comparable techniques. Optical absorption spectroscopy is used to measure absolute densities of selected reactive oxygen and nitrogen species to further elucidate the conversion mechanism based on these radicals. A mode-transition effect, also known from literature [4], can be observed for different volumetric flow rates and be replicated in both, the experiment and a complementary zero dimensional chemistry model. Finally, flow analysis by schlieren imaging is performed to illustrate the comparably high performance of the system, despite the low plasma to surrounding gas ratio.

[1] B. Offerhaus et al., Plasma Processes and Polymers 14 (2019).

[2] L. Schücke et al., Plasma Sources Science and Technology 29 (2020).

[3] N. Peters et al., Plasma Processes and Polymers 18 (2021).

[4] T. Shimizu et al., New Journal of Physics 14 (2012).

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