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ATOMIC SPECIES PRODUCTION BY MICROWAVE PLASMAS: MASS SPECTROMETRY CHARACTERIZATION

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Interaction of atomic species on surfaces is of primary importance to better control surface treatments assisted by remote plasmas. However, up to now, many attempts have been done to define these phenomena qualitatively and, to a lesser extent, quantitatively. For example, by looking at the recombination coefficients of N or O atoms on silica, one can see a large amount of data which are widely spread.

We report on the characterization by mass spectrometry of microwave remote plasmas used to create different types of atoms. The main purpose aimed at is to mix these atoms above surfaces of materials with variable reactivity to determine their interaction both in surface and in volume.

Different gas mixtures are used to create D, C2, N and O. Deuterium is preferred to hydrogen because of its heavier mass that makes it easier to measure by a quadrupole mass analyzer. Therefore Ar-D2, Ar-N2 and Ar-O2 mixtures are used and post-discharges are shown to contain D, N and O atoms. Knowing the cross section of the ionization processes, the concentration of each atomic element is determined for given experimental conditions by resorting to energy resolved spectroscopy.

The production of atomic carbon by interaction of an argon plasma with a graphite rod has not been detected. However, the synthesis of carbon dimmers was possible, at low concentration. The use of helium instead of argon allows us to synthesize C2 and to reach a concentration of a few ppm. This synthesis is assigned to the higher level of the metastable states of helium with regard to that of metastable states of argon. Despite it remains weak, it is clearly detected.

Analyses by optical emission spectroscopy are also performed to characterize the medium (gas temperature and emitting species).

Finally, the first results concerning the mixing of N and O atoms over a Teflon and a silica surface will be presented.

Keywords: remote plasma ; microwave ; atomic species ; mass spectrometry.