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Determining atom and radical surface recombination coefficients in low-pressure plasmas[1] JEAN-PAUL BOOTH, LPP-CNRS — In many low-pressure plasma processing applications (such as plasma etching), the dominant loss process for reactive atoms and free radicals is recombination at the reactor walls. This process is usually quantified by a phenomenological surface reaction coefficient, β, varying between 0 and 1, which is a crucial parameter for plasma modelling. As no reliable ab-initio theory exists to estimate the value of β for real surfaces, and as it may vary depending on the prevalent conditions, it must be measured in-situ. The simplest and most widespread technique is to determine the lifetime of the species in question in the afterglow of a pulsed plasma. The species density can be measured as a function of time using various methods including laser-induced fluorescence and time-resolved optical emission spectroscopy, and the coefficient is then derived using a diffusion model. This has been applied to many atoms (H, O, Cl, ...) and free radicals (CF, CF_2, ...) This method necessarily assumes that the coefficient is unchanged in the afterglow, which may be questionable. Furthermore, if the gas temperature in the steady state plasma is significantly above that of the walls, the temperature will vary in the afterglow period, and may even cause gas convection, making analysis difficult. An alternative is to measure the density gradient adjacent to the surface in the steady state. The pros and cons of these methods will be discussed with examples of measurements.

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Jean-Paul Booth
LPP-CNRS, Ecole Polytechnique

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