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Modeling of industrial plasma tools and applications: experimental validation SHAHID RAUF, SAMANEH SADIGHI, AJIT BALAKRISHNA, KALLOL BERA, JASON KENNEY, WEI TIAN, JUN-CHIEH WANG, Applied Materials, Inc. — Plasmas are widely used for thin film processing during microelectronics fabrication. Modeling is an important tool for design of these plasma systems, and experimental validation of these models is important. Rapid pace of technology development makes such validation challenging in an industrial environment. Several examples are used to illustrate different methods for validating and refining models of industrial plasma systems. Ideally, systematic plasma diagnostic measurements should be made on the actual plasma tool as was the case in our multi-frequency capacitive plasma source. n_e and T_e were measured using double probes in the 2 – 162 MHz range for several gases and pressures. If diagnostic data from the actual tool is not available, another option is to validate the models under similar conditions in a research reactor. For example, we are collaborating with Ecole Polytechnique on diagnostics in inductively coupled Cl_2, Cl_2/O_2 and HBr plasmas. Final processing results (e.g., etch rate) are often the most easily available data. Validating plasma models using such data relies on coupling the plasma simulations to a surface chemistry mechanism. Surface chemistry introduces uncertainties, but often the model can be reasonably validated if the data covers a wide range of conditions.

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