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Etching of Niobium in an Argon-Chlorine Capacitively Coupled Plasma[1] SVETLANA RADOVANOV, ANA SAMOLOV, Applied Materials, Varian Semiconductor, JANARDAN UPADHYAY, JEREMY PESHL, SVETOZAR POPOVIC, LEPOSAVA VUSKOVIC, Old Dominion University, APPLIED MATERIALS, VARIAN SEMICONDUCTOR TEAM, OLD DOMINION UNIVERSITY TEAM — Ion assisted etching of the inner surfaces of Nb superconducting radio frequency (SRF) cavities requires control of incident ion energies and fluxes to achieve the desired etch rate and smooth surfaces. In this paper, we combine numerical simulation and experiment to investigate Ar /Cl_2 capacitively coupled plasma (CCP) in cylindrical reactor geometry. Plasma simulations were done in the CRTRS 2D/3D code that self-consistently solves for CCP power deposition and electrostatic potential. The experimental results are used in combination with simulation predictions to understand the dependence of plasma parameters on the operating conditions. Using the model we were able to determine the ion current and flux at the Nb substrate. Our simulations indicate the relative importance of the current voltage phase shift and displacement current at different pressures and powers. For simulation and the experiment we have used a test structure with a pillbox cavity filled with niobium ring-type samples. The etch rate of these samples was measured. The probe measurements were combined with optical emission spectroscopy in pure Ar for validation of the model. The authors acknowledge Dr Shahid Rauf for developing the CRTRS code.

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Svetlana Radovanov
Applied Materials, Varian Semiconductor

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