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Surface Erosion of MAX Phase Micro-Trenches using a Plasma Jet from an Electrothermal Plasma Source[1] JONATHAN COBURN, North Carolina State University, T. E. GEBHART, CHAD PARISH, EZEKIEL UNTERBERG, DONALD HILLIS, Oak Ridge National Laboratory, MOHAMED BOURHAM, North Carolina State University — Erosion characteristics of plasma-facing component (PFC) materials must be evaluated under extreme edge localized mode (ELM) and hard disruption conditions. Investigation of material alternatives to tungsten is essential, allowing for solutions suitable for operating magnetic fusion reactor environments. Novel MAX phase ceramics were exposed to an electrothermal (ET) plasma source operated at Oak Ridge National Laboratory. A technique was developed using a dual FIB/SEM to carve micrometer-scale trenches into the surface of polished MAX samples. FIB ruler markings were etched in ˜1μm increments on a trench wall shadowed from plasma exposure. These samples were exposed to a lexan ET plasma stream in a He environment, at a specified impact angle, with IR camera and visible spectrometer diagnostics. Current pulses of 8kA over 160μs yielded heat fluxes of a few GW/m^2 on the sample surface. Post-experiment SEM analysis indicated that this heat flux was enough for surface melting and boiling, but not enough to achieve a fully sublimating erosion regime. FIB ruler markings indicate ˜1μm of erosion depth in melted/vaporized areas. Results encourage higher heat flux ET exposures for future studies of MAX phases, SiC, and other novel materials using this micro-trenching technique.

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