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Scaling microplasma arrays for material processing[1] CHEN WU, Tufts University, NAOTO MIURA, JUN XUE, MICHAEL GRUNDE, KEVIN MORRISSEY, JEFFREY HOPWOOD — Microwave-generated microplasma produces a dense, continuous discharge because the period of the electric field is shorter than the electron confinement time. The electrons are trapped in the plasma between two resonating microelectrodes driven at $\sim$1 GHz. Stark broadening of the atomic hydrogen emission shows the time-average electron density is $\sim 10^{14}$ cm^{-3} at atmospheric pressure in argon at 1 watt of absorbed power. Gas temperature remains less than 900 K according to laser diode absorption profiles of the Ar metastable states. These conditions suggest that microplasmas can provide a high ion flux to a surface while maintaining low surface temperatures. In an effort to scale the microplasma to lengths that are compatible with roll coating, we present coupled arrays of resonator-driven microplasma. Hundreds of microplasmas can be sustained in parallel using a single microwave power source. Coupled mode theory provides the physical description of these line-shaped cold atmospheric plasmas. Stability of the microplasma is due to detuning of each resonator by the plasma sheath capacitance and plasma resistance. Examples of hydrocarbon deposition will be discussed.

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