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Microplasma deposition of challenging thin films at atmospheric pressure JEFFREY HOPWOOD, H.C. THEJASWINI, Tufts University, PLASMA ENGINEERING LABORATORY TEAM — Non-equilibrium microplasmas produce fluxes of ions and excited species to a surface while maintaining the surface near room temperature. At atmospheric pressure, however, it is very difficult to accelerate the highly collisional ions. While many applications do not benefit from energetic interactions between plasma and surface, conventional plasma deposition of thin films often requires either ion bombardment or substrate heating. For example, diamondlike carbon (DLC) is known to require $\sim$ 100 eV ion bombardment and transparent conducting oxides (TCO) typically require substrate temperatures on the order of 400-500 K. A microwave-induced microplasma is used to dissociate dilute precursor molecules within flowing helium. The precursor and plasma species result in rapid deposition of thin films (>1 μm/min). This plasma produces a steady-state ion flux of 6x10^{17} cm^{-2}s^{-1}, which is more than two orders of magnitude greater than a low pressure capacitively coupled plasma. Likewise, the metastable density is roughly two orders greater. These and other microplasma diagnostics are correlated with the measured film properties of microplasma-deposited DLC and TCO. This study shows that high ion flux, even at low energy ($\sim$ 1 eV), can provide the needed surface interactions to produce these materials at room temperature.

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