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A Comparative Study of Polymer and Biomolecule Surface Modifications by an Atmospheric Pressure Plasma Jet and Surface Microdischarge in Controlled Environments ELLIOT BARTIS, ANDREW KNOLL, PINGSHAN LUAN, CONNOR HART, JOONIL SEOG, GOTTLIEB OEHRLEIN, University of Maryland, College Park, DAVID GRAVES, University of California, Berkeley, WALTER LEMPERT, The Ohio State University — In this work, polymer- and lipopolysaccharide-coated Si substrates were exposed to a surface microdischarge (SMD) and an atmospheric pressure plasma jet (APPJ) in controlled ambients. We seek to understand how plasma-ambient interactions impact biodeactivation and surface modifications by regulating the ambient gas chemistry and the proximity of the plasma to the ambient. A key difference between the SMD and APPJ is that the APPJ needs an Ar feed gas and the SMD does not. By adding small N_2/O_2 admixtures to Ar, we find that the O_2 admixture in the APPJ is a key factor for both deactivation and surface modification. After plasma treatments, we detected a new chemical species on a variety of surfaces that was identified as NO_3. We find that NO_3 forms even with no N_2 in the feed gas, demonstrating that this species forms due to interactions with ambient N_2. Despite a very different discharge mechanism, the SMD modifies surfaces similarly to the APPJ, including NO_3 formation. The SMD generates large O_3 concentrations, which do not correlate with NO_3, suggesting that O_3 alone is not involved in the NO_3 formation mechanism. The authors gratefully acknowledge financial support by the US Department of Energy (DE-SC0005105 and DE-SC0001939) and National Science Foundation (PHY-1004256).

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