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Mastering Interactions of Plasmas with Complex Surfaces[1]

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The translational nature of research in low temperature plasmas places high emphasis on the relationship between fundamental plasma transport properties and the intended application. This is nowhere more true than for plasma-materials interactions. These interactions take many forms, from production of secondary electrons through ion or photon bombardment which then affects the fluxes of those ions and photons; to synergistic self-organization of plasmas that may result from multi-phase interactions or the topography of the surface. The manner of coupling between the surface and the plasma is to some degree a function of the mean-free-path (mfp) for electron and ions, and the surface structures producing the feedback. Plasma-surface interactions in lower pressure plasmas with longer mfp's certainly affect the properties of the plasma, but distributed over a larger volume with weaker feedback. Higher pressure plasmas with smaller mfp's can localize that feedback, leading to greater synergies. Using results from computational modeling, the synergies of interactions of atmospheric pressure plasmas with complex surfaces will be discussed, and contrasted with those occurring at low pressure. The conditions leading to self-organization and pattern-dependent plasma transport will be discussed.

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