Abstract Submitted
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Electric field emission and local surface heating in plasma packed bed reactors having metal catalyst-impregnated dielectric beads[1] JULIUSZ KRUSZELNICKI, KENNETH ENGELING, JOHN E. FOSTER, MARK J. KUSHNER, Univ of Michigan - Ann Arbor — Atmospheric-pressure plasma packed bed reactors (PBRs) are being investigated for chemical conversion of gases and pollution control. Metallic catalysts added to the surfaces of the dielectric beads of PBRs increase the energy efficiency and selectivity of chemical conversion by providing additional reaction pathways. Experimental results have shown synergistic interactions between plasmas and catalyst particles, however the nature of these interactions is poorly understood. In this study, the plasma hydrodynamics modeling platform nonPDPSIM was used to simulate the interactions between micron-scale catalyst particles embedded in dielectric beads and humid-air plasma in PBRs. We found that the fluxes of excited species, ions, electrons and photons to the catalysts are focused primarily at the triple points between the metal, dielectric and gas. This effect is due to the enhancement of local electric field, which leads to an increase of the local plasma densities. As a result, the catalyst was locally heated, which could lead to increased reaction rates on the surface. The high electric field at the triple points produce field emission of electrons, which provides a preionization source or an additional source of electrons. These sources enable breakdown at lower applied voltages, therefore increasing the energy efficiency of the system.

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Mark Kushner
Univ of Michigan - Ann Arbor

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