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Properties Influencing Plasma Discharges in Packed Bed Reactors[1] JULIUSZ KRUSZELNICKI, KENNETH W. ENGELING, JOHN E. FOSTER, MARK J. KUSHNER, University of Michigan — Atmospheric pressure dielectric barrier discharges (DBDs) sustained in packed bed reactors (PBRs) are being investigated for CO_2 removal and conversion of waste gases into higher value compounds. We report on results of a computational investigation of PBR-DBD properties using the plasma hydrodynamics simulator *nonPDPSIM* with a comparison to experiments. Dielectric beads (rods in 2D) were inserted between two coplanar electrodes, 1 cm apart filled by humid air. A step-pulse of -30 kV was applied to the top electrode. Material properties of the beads (dielectric constant, secondary emission coefficient) and gas properties (photoionization and photo-absorption cross-sections, temperature) were varied. We found that photoionization plays a critical role in the propagation of the discharge through the PBR, as it serves to seed charges in regions of high electric field. Increasing rates of photo-ionization enable increases in the discharge propagation velocity, ionization rates and production of radicals. A transition between DBD-like and arc-like discharges occurs as the radiation mean free path decreases. Increasing the dielectric constant of the beads increased electric fields in the gas, which translated to increased discharge propagation velocity and charge density until $\varepsilon/\varepsilon_0 \approx 100$. Secondary electron emission coefficient and gas temperature have minimal impacts on the discharge propagation though the latter did affect the production of reactive species.

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