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Production of Reactive Species in 2-D Packed Bed Reactors – Impact of System Parameters[1] JULIUSZ KRUSZELNICKI, GUY PARSEY, MARK J. KUSHNER, University of Michigan — Control of chemical conversion using plasma-based Packed Bed Reactors (PBRs) is a complex function of system parameters, including gas flow rate, repetition rate and properties of the packing material. Impacts of these parameters were computationally investigated in a 2-dimensional PBR using the *nonPDPSIM* modeling platform. The system consisted of seven, 700-μm dielectric rods ($\varepsilon_r = 9.0$) inserted between two, coplanar electrodes with 10-ns DC pulses applied at frequencies between 100 Hz and 1 kHz. Humid air ($N_2/O_2/H_2O$ 78/21/1) was flowed through the system. Periodic boundary condition was applied to simulate the flow of gas through a longer PBR. We found that primary dissociation products (O, N, H, OH) formed at high rates near surfaces of the rods which then reacted with background gases, forming secondary species (O_3, H_2O_2, HO_2).. Increasing the permittivity of the rods led to higher plasma densities which favored production of reactive nitrogen species. Decreasing the separation between the rods led to similar effects while also producing gas-flow stagnation, which favored production of tertiary species (N_2O_x, HNO_4). Decreased pulse frequency and increased gas flow were both found to mitigate this stagnation.

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