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Nanoparticle-Plasma Interactions in Dusty Argon-Hydrogen Plasmas UWE KORTSHAGEN, MEENAKSHI MAMUNURU, Department of Mechanical Engineering, University of Minnesota — We studied the role of hydrogen in altering the plasma-nanoparticle interactions in low pressure dusty Ar-H_2 plasma. Most dusty plasmas in which particles form through chemical nucleation, are multi-component plasmas containing hydrogen. As hydrogen's ionization potential is close to that of argon, both gases may be ionized. The presence of the light mass hydrogen ions has the potential to modify the plasma and plasma-nanoparticle interactions. We developed a global model for dusty argon-hydrogen plasma. For given absorbed power, nanoparticle density, pressure, and chamber size, we solved the power balance, plasma species balance, and particle current balance equations. We included a system of rate equations for important argon-hydrogen plasma chemical reactions and obtained electron energy distribution function (EEDF) using ZDPlasKin. A trace amount of H_2 gas in Ar discharge causes Ar^+, ArH^+, and H_3^+ to be the dominant ions. Their relative densities are dependent on chamber pressure, gas composition, and the nanoparticle density. Increase in H_2 gas fraction reduces the plasma density. The presence of light ions reduces the average particle charge. Electron collisions with hydrogen and with the nanoparticles affect the EEDF shape. Overall, we find that the presence of H_2 in the discharge significantly alters the plasma properties and the fundamental plasma-nanoparticle interactions. This work was supported by the US Dept. of Energy Plasma Science Center and DOE grant DE/SC-0002391.

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