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Ion Energy Distribution Studies of Ions and Radicals in an Ar/H_2 Radio Frequency Magnetron Discharge During a-Si:H Deposition Using Energy-Resolved Mass Spectrometry SAMUEL MENSAH, University of Arkansas, HUSAM ABU-SAFE, Labanese American University, Byblos, HAMEED NASEEM, University of Arkansas, MATT GORDON, Denver University — Ion energy distributions of sputtered Si particles have been measured by an energy-resolved mass spectrometer, and we correlate the results with measured thin film properties. The plasmas have been generated in a conventional magnetron chamber powered at 150W, 13.56MHz at hydrogen flow rates ranging from 0-25sccm. Various H_n^+, SiH_n^+, SiH_n fragments (with n = 1, 2, 3) together with Ar^+ and ArH^+ species were detected in the discharge. The most important species for the film deposition is SiH_n with n = 0,1,2, and H fragments affect the hydrogen content in the material. The flux of Ar^+ decreases and that of ArH^+ increases when the hydrogen flow rate was increased. However both fluxes saturate at hydrogen flow rates above 15sccm. Plasma parameters, such as plasma potential V_p, electron density n_e and electron energy T_e, are measured with the Langmuir probe. The ion energy distribution (IED) of all prominent species in the plasma is measured with an energy resolved mass analyzer. The plasma parameters decreased with increasing hydrogen flow rate; V_p, n_e and T_e decreased from 36.5V, $7.2\text{x}10^{15}$ m^{-3}, 5.6eV to 32.8, $2.2\text{x}10^{15}m^{-3}$ and 3.8eV respectively. The ion energy of the heavy species, Ar, Ar^+, ArH, ArH^+,SiHn and SiH_n^+ radicals have ion energies comparable to the plasma potential. Analysis of the IEDs shows an inter-dependence of the species and their contribution to the thin film growth and properties.

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