Electron Capture by Silicon Ions from Helium at eV Energies

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Silicon is commonly found in a variety of astrophysical plasmas. Several charge-transfer recombination reactions by multiply charged silicon ions have been suggested and their effects on the ionization equilibrium of the plasmas have been discussed. We measured the charge transfer rate coefficients of Si^{3+} and Si^{4+} with helium at electronvolt energies by using the technique of laser-induced-plasma ion source and ion storage. The Si^{3+} and Si^{4+} ions are produced by laser ablation of solid silicon or tungsten disilicide targets and stored in an rf ion trap. The decay rates of the stored silicon ions are measured while the vacuum chamber of the ion trap is filled with helium gas with known pressures. The charge transfer rate coefficients are obtained from the decay rates and the helium densities. The equivalent reaction temperatures are estimated to be 3.9×10^3 K for $Si^{3+} + He \rightarrow$ products and 4.6×10^3 K for $Si^{4+} + He \rightarrow$ products. The comparison of the measured values with the calculated ones are given. A summary of our previous electron capture measurements (O^{2+}+ He, H_2, N_2 and CO; N^{2+}+ He, H_2, N_2 and CO; Fe^{2+}+ H_2) will also be given.

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