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Low energy positrons as probes of reconstructed semiconductor surfaces. NAIL G. FAZLEEV, ALEX H. WEISS, Department of Physics, University of Texas at Arlington — Positron probes of semiconductor surfaces that play a fundamental role in modern science and technology are capable to non-destructively provide information that is both unique to the probe and complimentary to that extracted using other more standard techniques. We discuss recent progress in studies of the reconstructed Si(100), Si(111), Ge(100), and Ge(111) surfaces, clean and exposed to hydrogen and oxygen, using a surface characterization technique, Positron-Annihilation-Induced Auger-Electron Spectroscopy (PAES). Experimental PAES results are analyzed by performing first-principles calculations of positron surface states and annihilation probabilities of surface-trapped positrons with relevant core electrons for the reconstructed surfaces, taking into account discrete lattice effects, the electronic reorganization due to bonding, and charge redistribution effects at the surface. Effects of the hydrogen and oxygen adsorption on semiconductor surfaces on localization of positron surface state wave functions and annihilation characteristics are also analyzed. Theoretical calculations confirm that PAES intensities, which are proportional to annihilation probabilities of the surface trapped positrons that results in a core hole, are sensitive to the crystal face, surface structure and elemental content of the semiconductors.

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