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Correlation of MS interface states to the Schottky barrier height and manufacture of the Metal-Silicon Schottky junction diode

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Investigation of metal-silicon interfaces to understand the early stages of silicide is important to both fundamental and device fabrication technology. In this work, the work function variation and the Schottky barrier height of epitaxial erbium silicide on silicon Schottky junction diodes are studied. Er-silicide is formed by epitaxial Er growth using molecular beam epitaxy (MBE) on p-type Si(100) at 550℃. Epitaxial erbium layers were grown in several steps on silicon substrate. After each growth step the surfaces were characterized *in situ* by X-ray photoelectron spectroscopy (XPS) and ultraviolet photoelectron spectroscopy (UPS). The uniformity of surfaces was confirmed by Atomic force microscope (AFM) analyses. We investigated the physical and chemical characteristics of Schottky contact that is formed on interface of metal/silicon through the observation of X-ray Photoelectron spectra. We measured the work function of silicide through high binding energy cutoff and determined band structures at low binding energy through valence-band spectra by UPS. The work function of samples after Er growth on silicon substrate decreases considerably comparing with the value of clean silicon substrate. We determined the Schottky barrier height for both interfaces from the variation of the work function of Er-silicide layer relative to the one of the clean silicon. We discussed the correlation between the formation of Er-silicide and the change of Schottky barrier height. We practically manufactured diodes and investigated the I-V characteristics of Schottky junction diodes as the thickness of Er-silicide layers increases.