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Fermi-level depinning in metal/Ge interface using oxygen plasma treatment

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Abstract—Oxygen (O_2) plasma treatment on germanium (Ge) surface was employed to depin Fermi-level in Al/n-type Ge interface. The Al contact to n-type Ge without and with O_2 plasma treatments for 1 and 2 min showed rectifying characteristics despite the low work function of Al, which could be associated with the Fermi-level pinning. An increase in O_2 plasma treatment time resulted in a decrease in Schottky barrier height along with the improvement of the homogeneity of Schottky interface. On the other hand, Al contact to O_2 plasma-treated n-type Ge for 3 min exhibited Ohmic behavior, implying the depinning of Fermi-level in Al/n-type Ge interface. A transition from rectifying to Ohmic behavior observed in Al/n-type Ge contact with O_2 plasma treatment for 3 min could be attributed to the more homogenous and stoichiometric formation of Ge-oxide layer. Such a high quality Ge-oxide layer effectively passivated unsatisfied surface states in Ge, which could be responsible for Fermi-level depinning of Ge.

Keywords: Fermi-level depinning; Ge; Ohmic; Schottky; Oxygen plasma treatment; Surface states

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