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Electrical properties of a Cu-germanide Schottky contact to n-type Ge depending on its microstructural evolution driven by rapid thermal annealing

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ABSTRACT

The electrical properties of Cu-germanide(Cu_3Ge)/n-type Ge Schottky contacts formed as a result of a solid state reaction between Cu and n-type Ge were investigated as a function of the rapid thermal annealing (RTA) temperature and correlated with its microstructural evolution driven by the RTA process. The variations of the barrier height of Cu_3Ge/n-type Ge Schottky rectifiers caused by the RTA process were determined using current-voltage (*I-V*) and capacitance-voltage (*C-V*) methods. The Cu_3Ge film formed after annealing at 400 °C exhibited a relatively uniform surface and interface morphology. This led to the formation of a laterally homogenous Schottky barrier in the Cu_3Ge/n-type Ge Schottky diode, resulting in an improvement of its rectifying *I-V* behavior. On the other hand, after annealing above 500 °C, the Cu_3Ge film was severely agglomerated without film continuity and eventually evolved into isolated islands at 600 °C. Such structural degradation of Cu_3Ge led to a rapid decrease in the barrier height and an increase in the reverse leakage current of the Cu_3Ge/n-type Ge Schottky diode. The electric field dependence of the reverse current showed that the reverse leakage current in the Cu_3Ge/n-type Ge Schottky diodes was dominated by a Poole-Frenkel emission mechanism, regardless of the RTA temperatures.

Keywords: Copper germanide; Schottky contact; Barrier height; Rapid thermal annealing; Reverse leakage current; Poole-Frenkel emission

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