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Solid state reaction of ruthenium with silicon carbide, and the implications for its use as a schottky contact for high temperature operating schottky diodes.

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Abstract content
   (Max 300 words)

A thin film of ruthenium was deposited on n-type 4H-SiC by electron beam deposition technique so as to study the interface behaviour of the ruthenium schottky contact with silicon carbide at various annealing temperatures. Ruthenium Schottky diode dots were also fabricated by using electron beam deposition of ruthenium on n-type 4H-SiC which had nickel deposited on it by resistive evaporation technique as back ohmic contact . The Ru-4H-SiC Schottky barrier diodes (SBDs) and Ru-4H-SiC films were both annealed isochronally in a vacuum furnace at temperatures ranging from 500 -1000 oC. After each annealing temperature, full IV and CV characterisation was performed on SBDs, and the Ru-4H-SiC thin films were analysed as well by Rutherford Backscattering spectrometry (RBS). Raman analysis of Ru-4H-SiC thin film which was annealed at 1000 oC was also done. RBS analysis showed evidence of ruthenium oxide formation and the diffusion of ruthenium into silicon carbide starting from annealing temperature of 700 oC going upwards. Raman analysis of the sample that was annealed in a vacuum at 1000 oC also showed clear peaks of ruthenium oxide, D and G carbon peaks which indicate the formation of graphite. Despite the occurrence of the chemical reactions and diffusion of ruthenium into SiC, the SBDs showed very good linear CV characteristics and excellent forward IV characteristics up to final annealing temperature of 1000oC.This is the first time in the World where a diode shows normal operation after annealing at a high temperature of 1000 oC. The SBDs had a small series resistance of below 20 Ω.The SBHs from IV characteristics were nearly equal to(but less than) 1eV and the ones obtained from CV characteristics were slightly higher than 1eV but less than 2 eV. The ideality factor for the most part was closer to 1 and showed very little variations at various annealing temperatures.

Apply to be
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Yes

Level for award
 (Hons, MSc,
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PhD

Main supervisor (name and email)
and his / her institution

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