Comparison of metal Schottky contacts on n-Ge (100) at different annealing temperatures

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1 Introduction Thin film reactions of metal on semiconductor have been of interest for the past 30 years for their applications in microelectronic devices [1]. In the manufacturing of semiconductor devices, metal contacts have always played a pivotal role, especially in MOSFET and CMOS devices. A good metal-semiconductor (MS) contact is essential for the successful operation of the electronic circuits and devices [2]. Contacts to very large scale integration (VLSI) circuits require MS contacts, which are thermally stable, have low resistivity and are compatible with the process technology. Schottky contacts play an important role in controlling the electrical performances of semiconductor devices [2]. The attempts to develop faster devices in modern microelectronics have increased the interest for alternative materials to silicon, compatible with the existing silicon-based technology [3]. Germanium (Ge) has been regarded as the replacement for silicon due to its high carrier mobility, low effective mass of holes [4] and relative compatibility with silicon processing. This has led to renewed interest in the complete understanding of metal-germanium interactions and electronic properties of radiation and process-induced defects in Ge.

The reactions of germanium with Pt[5, 6, 7], Ni [8,9,10,11,12], Pd [6,9,13,14,15] and Co [9,13,16,17] have also been investigated previously. Study of the solid state reaction between the metal films and germanium to determine the phase formation sequence [5,9,11,13,15,17], microstructure of material [9,10,12], growth kinetics[11,16] and electrical characteristics [9,10,12], were analyzed by x-ray diffraction, Rutherford backscattering spectroscopy, transmission electron microscopy, differential calorimetry and current-voltage (I-V) techniques respectively. Thaailnikis et al. [8] established a relationship between as-deposited Pd/n-Ge (111) and Ni/n-Ge (111) Schottky barrier height values, the metal work functions and the density of surface states of germanium substrate. Yao et al. [10] studied the I-V characteristics of Pt/n-Ge (001) and Ni/n-Ge (001) after subjecting the Schottky contacts to rapid thermal anneal (RTA) in N2 ambient in the temperature range 250-700 °C for 20 s. Han et al. [12] has reported the changes in the electrical properties of Ni germanide Schottky contacts on n-Ge (100) in the temperature range 300-500 °C.

The aim of this paper is to report the change in the electrical properties and give a comparative study of ther-