18p-D1-2

Homogeneity of WC *p*-type diamond Schottky interfaces

NIMS [1]
°Alexandre Fiori[1], Tokuyuki Teraji[1], Yasuo Koide[1]
E-mail: FIORI.Alexandre@nims.go.jp

Introduction In the past half-decade, diamond Schottky diodes are studied intensively for realizing high-performance rectifiers fulfilling both the high-voltage resistance in reverse bias operation and low on-resistance in forward bias operation, which is difficult to achieve using common semiconductor materials. High temperature stability and/or mechanical strength of diamond Schottky diode are important issues. Tungsten carbide (WC) has good high-temperature stability and mechanical hardness. In this study, reverse and forward characteristics of the WC/*p*-diamond Schottky interface and there thermal stability were investigated in wide voltage range.

Experiment Tungsten carbide, WC, Schottky contacts, with lateral configuration, were formed on *p*-type homoepitaxial diamond (100) films by magnetron sputtering[1]. The vacuum-ultraviolet (VUV)/ozone treatment was applied for surface oxidation. Diameter of the Schottky contacts is 150 µm. Annealed Ti/Au contact was deposited on the four corner of the specimen sample. On this sample, 49 diamond Schottky diodes were performed and their current-voltage characteristics were analyzer by a picoamperemeter in vacuum.

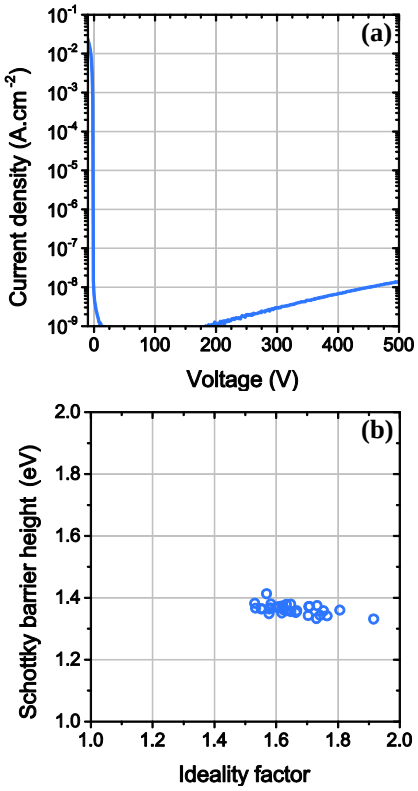

Fig. 1. (a) Typical forward and reverse *J–V* characteristics of WC Schottky diodes fabricated. (b) Schottky barrier height estimated from the J-V characteristics as a function of the ideality factor n.

Discussion Fig. 1(a) shows a typical forward and reverse *J–V* characteristics on the -10–500 volts range. More than 80% of these diodes exhibited a good rectification property with less than 1 pA at 10 V, and a forward linear behavior in logarithm scale over 5 orders of magnitude. Ideality factors and Schottky barrier heights were extracted from the fit for all forward characteristics, giving a nice statistic (see Fig. 1(b)). Reverse operation of 10 diodes were confirmed up the 100 V, and 5 of them were confirmed up to 500 V, with a typical leakage of 2 nA.cm^{-2} (≈0.5 pA) and 35 nA.cm^{-2} (≈10 pA) respectively. No breakdown were observed in this study. The thermal modification of WC diodes properties was also investigated. To do so, the temperature was increased, step-by-step, form the room temperature up to 750 K by 50 K. At each step, *J–V* characteristics were recorded, followed by a *J–V* characteristics at room temperature, in order to follow the diode modification.

Conclusion The *J–V* characteristics of WC/p-diamond Schottky diode were investigated. The tungsten carbide is thermally stable and has a good adhesion to the diamond, tough Schottky diodes were reproductively fabricated. This was confirmed by their rectification properties and their thermal deviation.

[1] T. Teraji et al., J. Appl. Phys. 111, 104503 (2012).