Surface Metal Effect on I(V) Characteristics Ti/6H-Sic Schottky Diode at RoomTemperature

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Introduction

The semiconductor industry is interested in materials that can fulfill the required conditions in the areas where silicon cannot fulfill the specifications such as for example applications in power electronics and microwave and applications in the field of photovoltaics. Thanks to its wide bandgap, good thermal conductivity and high chemical and physical stability, as well as a higher breakdown field than Si, solid silicon carbide SiC is an innovative success in components that operate at high temperatures. SiC also has interesting mechanical properties due to its hardness, its highresistance to heat[1,2,3,4].

Experimental/Theoretical Study

After the chemical cleaning process, the surface of SiC device was thermally oxidized. The oxide was removed at high frequency. Schottky Titanium contact was deposited tillthe layer formed a square contact of variable side: big, medium and small (1.6×1.6, 0.04×0.04, 0.16×0.04 mm^2).The active layer was n- doped with N_D=8.8.x 10^{15} cm^3 with a thickness of 7 µm. I(V) measurements are taken at room temperature and plotted in Fig.1. We used several mathematical models (graphical and LMS methods) to extract the electrical parameters: saturation current (Is), ideality factor (n), series resistance (R_S) and shunt resistance (Rsh) which are presented in table.1.

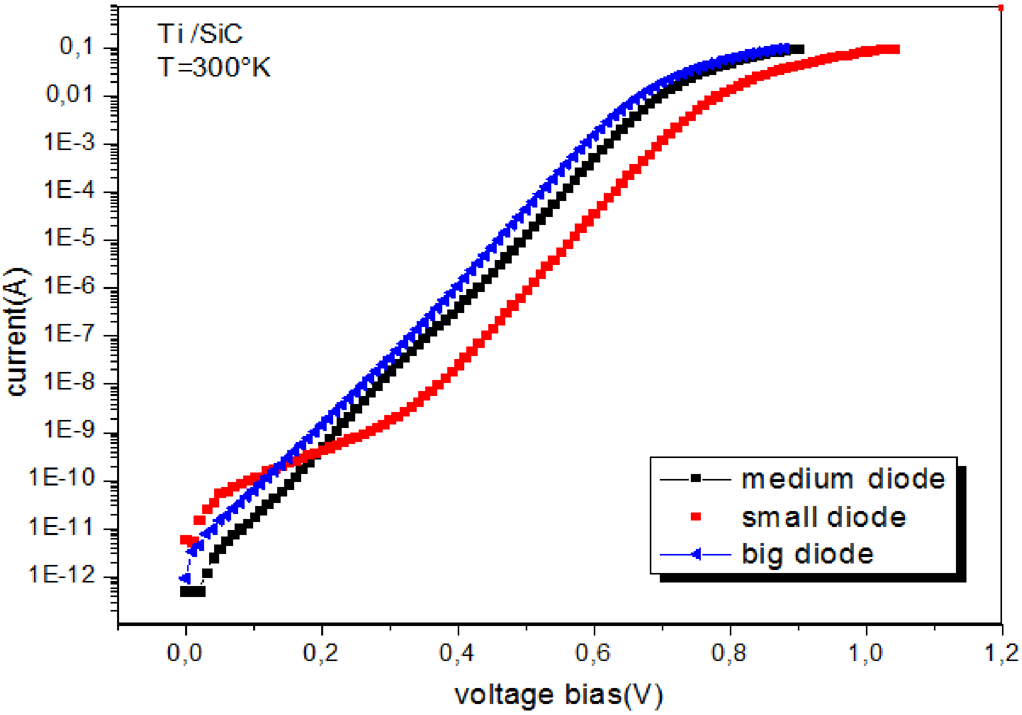

Fig.1: Experimental characteristics I (V) ofTi/SiC-6H Schottky diode.

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Results and Discussion

The I(V) characteristics shows two types of diodes, big and medium diodes present a normal behavior; for the small diode, the I(V) characteristics show a double-barrier phenomenon, one high (n^H, Rs^H, Is^H) and the other low (n^L, Rs^L, Is^L).

Table .1: Extraction of the electrical parameters for thesamples by the graphical and LMS methods.

	Parameters	**Big diode**	**Medium diode**	**Small diode**
Ln(I)-V	**Is^H (A)**	**5.60 E-13**	**1.38 E-13**	**1.54 E-14**
	n^H	**1.12**	**1.12**	**1.07**
	Rs^H (Ω)	**3**	**4.2**	**3.8**
	Rsh (Ω)	**9.5 E9**	**5.9 E9**	**4.7 E9**
	Is^L (A)	**-**	**-**	**2.01 E-14**
	n^L	**-**	**-**	**0.69**
	Rs^L (Ω)	**-**	**-**	**4.3 E8**
Cheung	**n**	**1.04**	**1.08**	**1.12**
	Rs (Ω)	**1.51**	**1.61**	**2.03**
Werner	**n**	**1.04**	**1.06**	**1.11**
	Rs (Ω)	**1.58**	**1.67**	**2.05**
	Is^H (A)	**5.33 E-13**	**1.55 E-13**	**2.63 E-14**
	n^H	**1.12**	**1.13**	**1.10**
	Rs^H (Ω)	**1.89**	**2**	**2.44**
	Rsh (Ω)	**2.77 E10**	**2.27 E10**	**6.63 E8**
	Is^L (A)	**-**	**-**	**1.06 E-11**
	n^L	**-**	**-**	**1.25**

Conclusion

The analysis of the I(V) characteristics at various forward voltage bias is showing a double-barrier phenomenon in the small diode. It is an inhomogeneity characterized by two independent diodes in parallel, one high and the other low. I(V) characteristics at different temperatures were used to investigate the active defects in the epitaxial layer.

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