Effect of Surface Inhomogeneities on the Electrical Characteristics of SiC Schottky Contacts

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***Abstract*— This paper reports analysis of the role of defects on the electrical characteristics of high-voltage 6H-SiC Schottky rectifiers. The measured reverse leakage current of high-voltage Ti and Pt rectifiers was found to be much higher than that predicted by thermionic emission theory and using a barrier height extracted from the C-V measurements. In this paper, a model based upon the presence of defects at the 6H-SiC/metal interface is used to explains this behavior. It is proposed that these defects result in lowering of the barrier height in the localized regions and thus, significantly affect the reverse I-V characteristics of the Schottky contacts. The presence of electrically active defects in the Schottky barrier area has been verified by EBIC studies.**

I. Introduction

In last decade, silicon carbide (SiC) has been given a renewed attention as a potential material for high-power and high-frequency applications requiring high-temperature operation [1]–[3]. The inherent properties of SiC such as large breakdown electric field strength, large saturated electron drift velocity, small dielectric constant, reasonably high electron mobility, and high thermal conductivity makes SiC an attractive candidate in applications for which silicon and GaAs based devices are not adequate. Recently various investigators have reported results pertaining to SiC devices for applications including that for high-temperature electronics [4], [5], for high-voltage and power devices [5]–[9] and for high power microwave applications [10], [11].

For both the power electronic and high-frequency applications, SiC Schottky diodes can offer significant advantages over Si or GaAs based devices. Specifically, for power electronic applications, due to the limitations of Si based Schottky diodes and *P-i-N* rectifiers, there is a need for the development of high voltage power rectifiers which can operate at fast switching speed with minimum reverse recovery current and with low on-state voltage drop. In a theoretical analysis to evaluate the performance of ideal high-voltage SiC Schottky rectifiers, it was shown that a 1000 V 6H-SiC diode will have a forward voltage drop of ≈ 1 V at a current density of 100 A/cm^2 [12].

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A number of authors have investigated the nature of Schottky contacts fabricated on 3C-SiC [13]–[15] and on 6H-SiC [8], [9], [16]–[21]. Waldrop and co-workers studied the dependence of barrier height of Schottky contacts to 6H-SiC on the metal work-function [22], on SiC doping (n-type vs. p-type) [23] and on SiC crystal face (C vs. Si face) [24]. It was found that contrary to the earlier reported conclusions of Fermi level pinning at the interface due to the surface states [16], the SiC/metal barrier-height was indeed dependent on the metal work-function [22], [23]. Recently, high voltage SiC Schottky rectifiers using Pt and Ti as the Schottky contacts have been reported [8], [9], [21]. These devices were found to have excellent forward I-V characteristics with an ideality factor of ≈ 1.05 and an on-state voltage drop ≈ 1.1 V at 100 A/cm^2 for 400 V Ti or Pt devices. For Au/6H-SiC diodes with breakdown voltage exceeding 1100 V, ideality factor was ~ 1.2 and on-state voltage drop was ~ 2 V at 42 A/cm^2 [8]. For these unterminated devices the breakdown voltage was approximately 60–70% of the theoretical value.

In general for SiC Schottky contacts, it has been observed that the reverse leakage current is about 2 orders of magnitude higher than the theoretically calculated value obtained using the barrier height extracted from the C-V measurements [8], [9]. From the point-of-view of actual applications, this large leakage current in high-voltage and high-frequency power Schottky diodes is not desirable since it may limit the current-voltage handling capability of these devices due to excessive power dissipation in the reverse blocking mode.

In this paper a model is presented to explain the unusually high leakage current observed in 6H-SiC Schottky rectifiers. This model is based upon the presence of localized defects in the epitaxial layer at the SiC/metal interface which may lower the barrier height of the Schottky contact at the defect site. An analytical implementation of this model is proposed which allows an analysis of the reverse I-V characteristics of diodes in which spatial variation in the Schottky barrier height exist due to these defects. 2-D numerical simulations using the simulator MEDICI were carried out for a detailed study of the role of these defects on the electrical characteristics. EBIC studies were carried out to verify the presence of localized electrically active defects at the SiC/metal interface and in the 6H-SiC epilayer.

II. Experimental Results

The experimentally measured reverse I-V characteristics at 300 K for Pt and Ti Schottky rectifiers fabricated using 6H-SiC

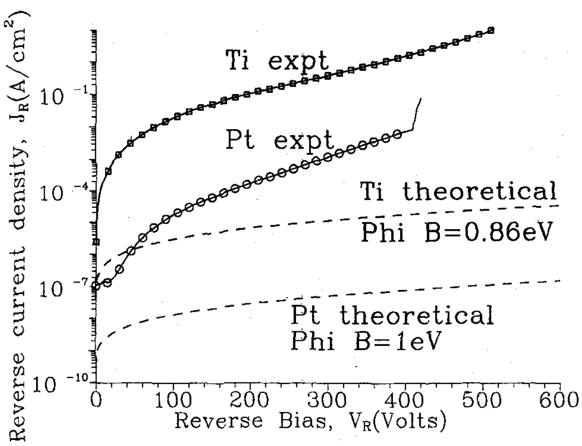


Fig. 1. Experimental and theoretical reverse I-V characteristics at 300 K for 6H-SiC Schottky contacts fabricated using Ti and Pt contacts.

epitaxial layers with doping of 2–4 $\times$ 10^{16} cm^{-3} are shown in Fig. 1. The breakdown voltage of the unterminated Ti and Pt devices were about 500 V and 400 V, respectively. In this figure, theoretically calculated reverse leakage currents are also shown. For calculating the leakage current, it was assumed that the 6H-SiC/metal contacts obey ideal thermionic emission theory and the reverse saturation current density (J_S) is given by [25]

$$J_S = A^{**}T^2 e^{\frac{-q(\Phi_b - \Delta\Phi_B)}{kT}} \tag{1}$$

where, Φ_B is the barrier height of the SiC/metal Schottky contact and $\Delta\Phi_B$ is the barrier-height lowering, and A^{**} is the effective Richardson's constant. To calculate J_S, experimentally measured barrier heights of 0.86 eV and 1 eV were used for Ti and Pt Schottky contacts, respectively [20], [21], [24]. The image-force related barrier-height lowering $(\Delta\Phi_B)$ due to the electric field across the metal/SiC interface (E_y) is given by

$$\Delta\Phi_B = \sqrt{\frac{qE_y}{4\pi\varepsilon_s\varepsilon_0}}. \tag{2}$$

E_y in turn depends on the applied reverse bias (V_R) and the semiconductor doping (N_D) and is given by the following relation

$$E_y = \sqrt{\frac{2qN_DV_R}{\varepsilon_s\varepsilon_0}}. \tag{3}$$

It can be seen from Fig. 1 that the theoretically calculated leakage current (I_R^{theo}) is at least 1–2 orders of magnitude lower than the experimentally measured leakage currents (I_R^{expt}) for both Ti and Pt contacts. Typically, for Pt contacts at 300 K and at a bias of -10 mV, the measured leakage current density is $\approx 10^{-7}$ A/cm^2 and the calculated saturation current density is about 10^{-9} A/cm^2. Similarly for the Ti devices, the measured and the calculated leakage current density at -10 mV are approximately 10^{-6} and 10^{-7} A/cm^2, respectively. It is worth pointing out that the leakage current for Ti diodes was consistently higher than that for the Pt devices. This dependence of leakage current on the barrier height is qualitatively consistent with thermionic emission theory since the barrier height of Pt is higher than that of Ti. Additionally, this behavior cannot be explained on the basis of leakage current associated with edge- or surface-generation since the magnitude of current components associated with these mechanism would be independent of the barrier height. In contrast to the reverse I-V characteristics, the measured forward I-V characteristics for the 6H-SiC Schottky contacts matches very well with the characteristics calculated using a barrier height determined by the C-V measurements and measured specific on-resistance.

III. Analytical Model

In this section, a model is presented to explain the high reverse leakage current experimentally observed in 6H-SiC Schottky diodes fabricated using Ti and Pt metallizations. The model is based on the presence of defects which result in lowering of the Schottky barrier height (SBH) in localized regions. It is shown that due to the presence of these Schottky barrier height inhomogeneities (SBHI), only the reverse I-V characteristics of the diode would be affected and the forward I-V and C-V characteristics would mostly remain uninfluenced. Fig. 2 shows a schematic of the 6H-SiC structure that was used for modeling the presence of a localized SBHI. A vertical device with a backside ohmic contact has been assumed. In this structure, two regions of the SiC/metal interface are identified. The high-SBH (HSBH) region is the defect free SiC/metal interface where the barrier height is chosen to be equal to the value obtained by the C-V measurements on the actual 6H-SiC Schottky contacts. The region where lowering of the barrier height occurs is identified as the low-SBH (LSBH) region. The ratio of the area of the low-SBH region to the total diode area is defined as Z. In this model, discontinuity in the potential profile at the boundary of the low-SBH and high-SBH region has been neglected. Thus, in this analytical approach it is assumed that these two regions with different barrier heights are equivalent to two Schottky diodes connected in parallel. The total saturation current density of the Schottky contact is then given by

$$J_S = J_S^L \cdot Z + J_S^H \cdot (1 - Z) \tag{4}$$

where J_L^S and J_H^S are the saturation current density through the LSBH and HSBH regions, respectively. Saturation current density of the HSBH and LSBH regions are calculated by using (1) with appropriate barrier heights. The difference in the barrier height of the LSBH (Φ_L) and HSBH (Φ_H) regions is defined as $\delta\Phi_B$. For modeling the room-temperature I-V characteristics, calculations were carried out for $\delta\Phi_B$ ranging from 0.1–0.4 eV and Z in the range of 0.001–0.1. The ratio of the saturation current of a device with a defect modeled as SBHI (I_{SBHI}) to the saturation current of a defect free diode (I_{IDEAL}) has been defined as R_J. Fig. 3 shows the variation in R_J for a device with a ϕ_H of 0.85 eV (corresponding to the barried height of Ti) as a function of $\delta\Phi_B$ and Z. In this

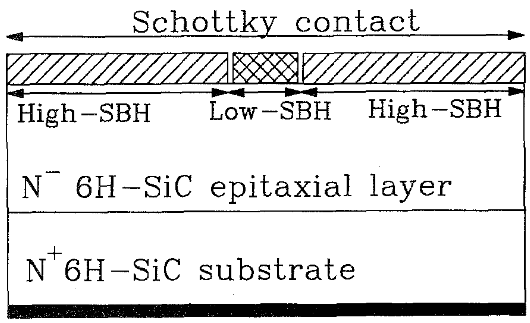


Fig. 2. A schematic of the 6H-SiC/Ti Schottky contact with a localized Schottky barrier height inhomogeneity.

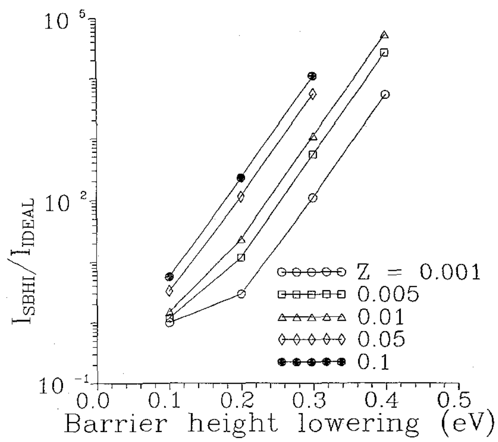


Fig. 3. The variation in the ratio of the leakage current through a 6H-SiC device with SBHI to that of an ideal device as a function of the SBHI parameters.

case, I_{IDEAL} was calculated using (4) with Z being equal to zero.

For a given temperature and Z, R_J strongly increases with $\delta\Phi_B$ and even for a small Z such as 0.01, it is as high as $\approx$ 25 and $\approx$ 1100 for a $\delta\Phi_B$ of 0.2 eV and 0.3 eV, respectively. In fact for a device with large $\delta\Phi_B$, most of the reverse leakage current flows through the defective region and the contribution from the high-SBH region is minimal. The dependence of R_J on the area ratio Z is approximately linear as suggested by (4). Table I shows the dependence of R_J on $\delta\Phi_B$ and Z. As expected, the parameter of importance in determining the effect of the barrier height lowering on the reverse I-V characteristics is not merely $\delta\Phi_B$ but the value of $\delta\Phi_B$ normalized to the temperature. Thus, for the given values of $\delta\Phi_B$ and Z, R_J decreases with increasing temperature. This implies that the effect of Schottky barrier height inhomogeneity on the reverse I-V characteristics is more significant at lower temperatures.

It was found that the influence of SBHI on the forward I-V characteristics is negligible except at very small biases. For small values of the on-state bias, the current was found to be higher for devices with Schottky barrier height inhomogeneity as compared to the ideal devices. However, as the voltage was increased, the contribution of the current component from the LSBH region decreased due to the influence of the resistance of the epitaxial layer. For current densities above 1 A/cm^2, the difference in the on-state current for the diodes with and without SBHI was negligible. Thus, the proposed model results in a large increase in the reverse leakage current without significantly altering the forward I-V measurements.

Though, this analytical model is adequate to illustrate the effects of SBHI parameters on the reverse I-V characteristics, it is not an accurate model to simulate the spatial variation in barrier height across a Schottky contact. This is due to the fact that in this model the potential discontinuity at the boundary of the low-SBH and the high-SBH was ignored. In fact, since a small region of the low-SBH contact is surrounded by a large area contact with higher SBH, it is expected that the potential profile in the region with lower barrier height would be influenced by the region with higher SBH [26], [27]. This would result in the potential distribution under the low-SBH contact to be different from the case where the entire contact was a low-SBH contact. So, the potential profile under the low-SBH region would tend to be similar to that under the high-SBH region and this would result in a pinch-off of the low-SBH region [27]. Thus, it would no longer be possible to assume that the low-SBH and high-SBH regions are equivalent to two parallel Schottky contacts to SiC with different barrier height and it would be necessary to include the pinch-off effect in calculating the electrical characteristics of diodes with Schottky barrier height inhomogeneities.

IV. Numerical Simulations

In order to take into account the aforementioned pinch-off effect, numerical simulations were carried out for Schottky structures similar to the one shown in Fig. 2 using 2-D numerical device simulator MEDICI [28]. Appropriate modifications in various model parameters, such as the impact ionization coefficients and electron and hole mobility values were incorporated to simulate the 6H-SiC based devices.

For simulating 6H-SiC Schottky contacts with regions of Schottky barrier height inhomogeneity, low-SBH regions were assumed to be in the center of the high-SBH region. This was achieved by specifying two separate Schottky contacts with different metal work functions to the 6H-SiC N$^-$-epitaxial layer. Since the two metal contacts were physically separated, a gap was present between the two contacts. In order to prevent any distortion in the potential profile due to this gap, a grid spacing of about 20 Å was used at the boundary of the low-SBH and high-SBH regions. For these simulations, the epitaxial layer doping was 2×10^{16} cm^{-3}, the barrier height of the defect-free region (Φ_H) was 0.8 eV, $\delta\Phi_B$ was taken as 0.2 and 0.4 eV and a linear geometry device with an area ratio Z of 0.024 was used.

Figs. 4 and 5 show the forward and reverse I-V characteristics of a 6H-SiC Schottky contact at 300 K with a $\delta\Phi_B$ of 0.2 eV. In these figures, the unit of y-axis is A/μm and it represents the current flowing thorough a device of linear

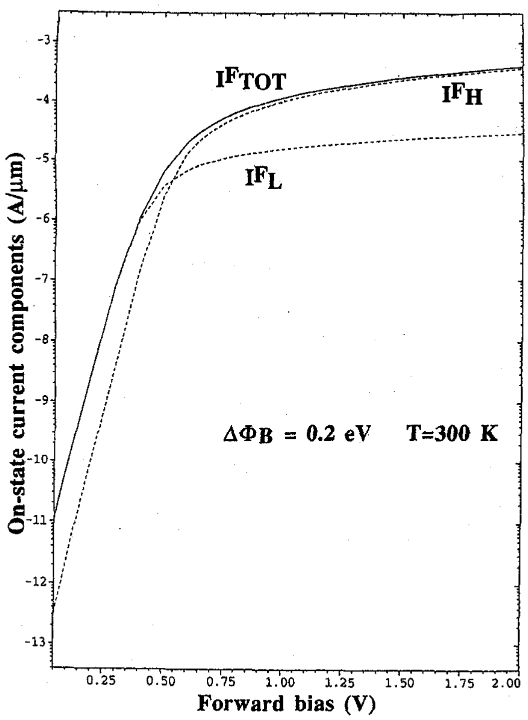


Fig. 4. The forward I-V characteristics at 300 K of a 6H-SiC Schottky contact with Schottky barrier height inhomogenity of $\delta\Phi_B = 0.2$ eV and $Z = 0.024$.

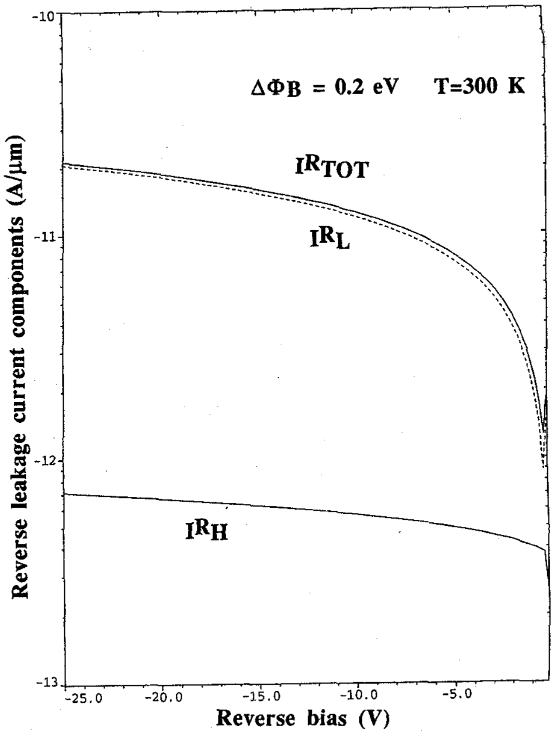


Fig. 5. Reverse I-V characteristics at 300 K of a Schottky contact with a SBH inhomogenity. The leakage current components due to the high-SBH and low-SBH regions are also shown.

geometry, such as shown in Fig. 2, with a depth of 1 μm in z-axis. For these simulations the device width was ~ 5 μm and thus, numerically obtained current density (A/cm^2) can be simply calculated by dividing y-axis values with 5×10^{-8}. In these figures, the contribution of the on-state current through the high-SBH and low-SBH region are indicated by I_H^F and I_L^F, respectively.

During on-state conduction, at very low on-state biases, most of the leakage current flows through the LSBH region and the total on-state current ($I_{\rm TOT}^F$) is approximately equal to I_L^F. However, at higher on-state biases, the voltage drop across the epitaxial layer resistance becomes large for the low-SBH region due to its higher on-state current density and thus, I_L^F tends to saturate much faster than I_H^F. This results in $I_{\rm TOT}^F$ becoming approximately equal to I_H^F for biases above 0.6 V. Based on these simulations it is concluded that at on-state biases of greater than 1 V, the on-state behavior of the Schottky contact with the Schottky barrier height inhomogeneity is identical to that of a defect-free device. It should be pointed out that in the simulated devices, the drift region thickness was assumed to be 1 μm as compared to a typical value of about 8 μm for 1000 V 6H-SiC diodes. This was done so as to minimize the number of grid-points used during simulation and consequently, to decrease the run-time. Furthermore, in fabricated devices, there are additional contributions from the substrate and contact resistances to the specific on-resistance. Thus, the total resistance in series with the Schottky diode for fabricated devices is much higher than the on-resistance used in the simulations. This would result in the influence of Schottky barrier height inhomogeneity on the forward I-V characteristics to be even smaller for the fabricated devices as compared to the simulated results.

Fig. 5 shows the reverse I-V characteristics of this device with SBHI for applied biases up to -25 V. The component of the reverse leakage current through the low-SBH and high-SBH regions are indicated by I_L^R and I_H^R, respectively and the total leakage current through the device is shown by $I_{\rm TOT}^R$. This figure indicates that even for a Schottky barrier height inhomogeneity with small $\delta\Phi_B$ and $Z, I_{\rm TOT}^R$ is dominated by the current through the LSBH region. For a diode with a SBHI region of $\delta\Phi_B$ of 0.2 eV and Z of ~ 0.025, the leakage current density is $\sim 4 \times 10^{-4}$ A/cm^2 at a reverse bias of 25 V. For a defect-free diode, this value is $\sim 1.2 \times 10^{-5}$ A/cm^2. As expected, the ratio of I_L^R to I_H^R at any given bias was found to increase with increasing $\delta\Phi_B$. This ratio is ≈ 30 and ≈ 5000 for devices with Schottky barrier height inhomogeneity of 0.2 and 0.4 eV, respectively. The corresponding values from the analytical model are ≈ 60 and 130 000, respectively. This difference in the analytical and numerical results is clearly due to the overestimation of the contribution of I_R^L in the analytical model. As mentioned earlier, this is due to the fact that in the analytical model the effect of the pinch-off of the LSBH region by the surrounding HSBH region was neglected which resulted in the analytical model being inaccurate in estimating the reverse leakage current through the LSBH region.

Table II lists the results of the numerical simulation for the forward and reverse I-V currents of 6H-SiC Schottky

TABLE I
THE DEPENDANCE OF THE RATIO OF I_{SBHI} TO I_{IDEAL} AS A FUNCTION THE SCHOTTKY BARRIER HEIGHT INHOMOGENITY PARAMETERS, $\delta\Phi_B$ AND $Z(T = 300\ \mathrm{K})$

Z	$\delta\Phi_B$ (eV)			
	0.10	0.2	0.3	0.4
0.001	1.0	3	111	5258
0.005	1.2	12	550	26286
0.01	1.5	24	1099	52572
0.05	3.3	116	5490	262855
0.10	5.7	230	10980	525708

TABLE II
NUMERICAL SIMULATIONS RESULTS FOR THE FORWARD AND REVERSE I-V CURRENTS FOR 6H-SIC SCHOTTKY DEVICES WITH AND WITHOUT SBHI ($Z = 0.024; T = 300\mathrm{K}$)

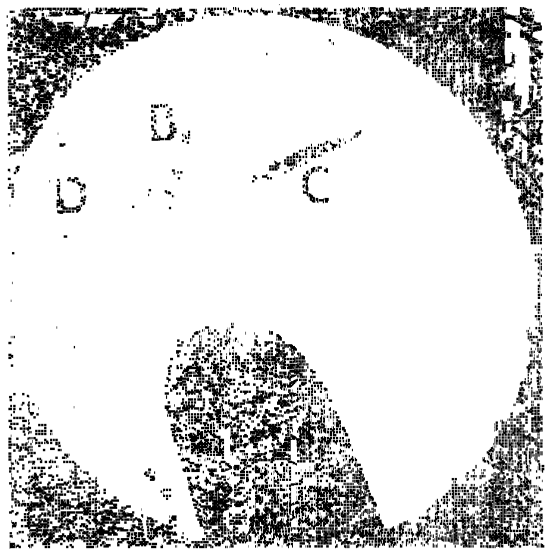
Bias	$\delta\Phi_B = 0.4$ eV			$\delta\Phi_B = 0.2$ eV		
	I_{Ideal}	I_{Tot}	I_{Tot}/I_{Ideal}	I_{Ideal}	I_{Tot}	I_{Tot}/I_{Ideal}
0 V	5×10^{-13}	5.5×10^{-10}	$\approx$1000	4×10^{-13}	1.2×10^{-12}	3
-25 V	8.5×10^{-13}	4.5×10^{-8}	$\approx$5000	7×10^{-13}	2×10^{-11}	$\approx$ 30
1 V	6×10^{-5}	8×10^{-5}	1.3	8×10^{-5}	9×10^{-5}	1.1

contacts at 300 K with and without any Schottky barrier height inhomogeneity. As observed in Section III, the numerical simulations also show that the effect of the presence of the Schottky barrier height inhomogeneity on the on-state characteristics is very small even for a large value of $\delta\Phi_B$, such as 0.4 eV. On the other hand, localized lowering of the barrier height, can significantly affect the reverse I-V characteristics of 6H-SiC/metal Schottky contacts. The ratio of the numerically calculated leakage current of a diode with inhomogeneity (I_{Tot}) to the leakage current of an ideal diode (I_{Ideal}) is also shown in this table. At 300 K, for a Z of 0.024, and $\delta\Phi_B$ of 0.2 eV and 0.4 eV, this ratio is $\sim$ 30 and $\sim$5000, respectively. Based on the results of fabricated Ti/6H-SiC Schottky contacts, the ratio of the experimentally measured leakage current to the ideal values at a bias of -25 V is $\sim$ 800–1000. Presently, the value of $\delta\Phi_B$ and Z in fabricated devices is not known and would require detailed characterization of the homoepitaxially grown epitaxial layers. However, the results of numerical simulations indicates that the presence of defect at the SiC/metal Schottky interface can indeed account for the unusually high reverse leakage currents obtained in the fabricated devices.

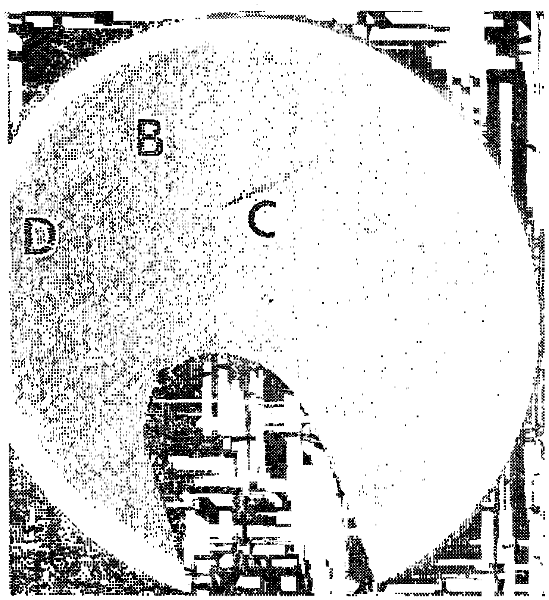
V. EBIC STUDIES

The EBIC measurements were carried out on as-deposited SiC Schottky contacts fabricated using $\approx$ 1000 Å of titanium metallization and N^- 6H-SiC epitaxial layers grown on the N^+ 6H-SiC substrates. Schottky contacts were fabricated using a fabrication process similar to the one used in [9]. For Schottky contacts Ti was used instead of Pt because it is expecetd that due to the lower atomic number of Ti, it would be more transparent to an electron beam as compared to Pt.

EBIC profiles of a typical 6H-SiC/Ti Schottky contact at accelerating potential of 25 KeV and 10 KeV are shown in



(a)



(b)

Fig. 6. EBIC profile of 6H-SiC/Ti Schottky contacts at zero bias and at accelerating potentials of (a) 25 KeV (b) 10 KeV.

Fig. 6. In this micrograph, several different types of defects or EBIC artifacts are identified and labeled according to their behavior with respect to the accelerating potential.

Type-B defects characteristically darken and become larger at higher accelerating potentials. This is because as the beam potential is increased, the electron beam induced excitons reach deeper portions of the defects and thus, results in a stronger signal from the defect. Another reason for this effect is that as the accelerating potential is increased, the interaction volume increases and the resolution is lost which may also make Type-B defects appear larger. Typical density of Type-B defects is about 10^4–$10^5/\mathrm{cm}^2$ which is close to the etch-pit density observed for homoepitaxially grown 6H-SiC epitaxial layers [29]. Based on the EBIC response of these defects with varying potential, it appears that these defects are line-defects which extend vertically into SiC epitaxial layer. Line-defects that are typically observed in the homoepitaxially grown 6H-SiC films similar to the one used for this study, can be classified in two types—glide dislocations and screw dislocations [29]–[32]. Glide dislocations are found to be parallel to the basal plane where as the screw dislocations typically run parallel to the growth axis. Based on the x-ray topographic studies of 6H-SiC films, density of screw dislocations was estimated to be higher than 10^4 cm^{-2} [31], [32]. Screw dislocations with a large core diameter of about 1 μm or more are called superscrew dislocations and are often visible as micropipes with a typical defect density of about 75–100 cm^{-2} in the state-of-the-art 6H-SiC epitaxial layers [33]. These defects are considered a major impediment to the development of large area high-voltage power devices since for materials with micropipes, the device breakdown occurs at a value much below the ideal breakdown voltage in the localized regions near the defects [3], [34]. Powell *et al.* used HCl etching at 1350°C to decorate defects on CVD grown 6H-SiC films and reported an etch pit density exceeding 10^4 cm^{-2} for 6H-SiC films that were grown on 6H-SiC substrates produced by modified-Lely method [29]. Based on the reported density and characteristics of screw dislocations, it is likely that the screw dislocations which originate in the bulk material and extend up to the surface of the epitaxial layers, are observed as Type-B defects in the EBIC images. This suggests that for these epitaxial layers, the defects that appear as etch-pits on etching in a solution, such as, molten KOH or HCl [29], [35], are indeed electrically active. Based on the EBIC studies it can be concluded that these defects can significantly influence the nature of the SiC/metal interface and thus, can affect the electrical characteristics of SiC Schottky contacts.

Other types of defects that are observed in the EBIC images include Type-C and Type-D defects. Type-D defects appear to be point defects similar to Type-B defects but unlike Type-B defects, these features become darker with a decrease in the e-beam accelerating potential. Since, the ratio of the surface to bulk signal increases with increasing e-beam potential, it is expected that these point defects are located at the metal/SiC interface and unlike Type-B defects, do not extend into the epitaxial layer. The exact nature and origin of these defects is not understood presently. One possibility is that these defects are simply particulate contamination that was present on epitaxial layer surface prior to metallization. Type-C defects are elongated features with a trailing edge and have a distinct characteristic that though their size and the position appear to change as the beam potential is changed, their orientation remains the same (Fig. 6). Similar to Type-B defects, Type-C defects are also likely to be dislocations present in the epitaxial film. However, unlike dislocations which run parallel to the growth axis and are imaged as Type-B defects, dislocations corresponding to Type-C defects seem to be directed at an angle with respect to the c-axis and extend laterally into the bulk material. The homoepitaxial layers used for this study were grown on 6H-SiC wafers that were 3–4° off-axis with respect to the c-axis and thus, the epilayer surface was not exactly parallel to the basal plane. It is possible that due to this off-axis nature of the substrate, the glide dislocations that are parallel to the basal plane may appear in the EBIC image as Type-C defects. It is also possible that Type-C defects correspond to some screw dislocations that can be present at an angle of up to 15° with respect to the growth axis of 6H-SiC epilayer [32]. At this point the exact nature of Type-C defects is not known and further studies using EBIC and transmission electron microscopy (TEM) techniques are required to identify the nature and origin of these defects.

VI. Conclusion

In this paper, a model is presented to explain the unusually high reverse leakage current observed in 6H-SiC Schottky diodes fabricated using Ti and Pt contacts. The measured reverse I-V characteristics show a distinct dependence on the barrier height which precludes the possibility of leakage current components due to the edge- or surface-generated currents. In the proposed model, it is suggested that there are localized regions at the SiC/metal interface where Schottky barrier height is lowered due to the presence of epitaxial layer defects at the 6H-SiC/metal interface. Analytical calculations and numerical simulations of 6H-SiC Schottky contacts with barrier height inhomogeneities have been carried out to study the effect of localized regions with defects on the forward and reverse I-V characteristics of SiC Schottky rectifiers. Qualitatively, these characteristics are in good agreement with the measured device characteristics for 6H-SiC Schottky contacts. EBIC measurements were used to verify the existence of different types of electrically active defects under the Schottky contact. Further studies employing cross-sectional TEM and EBIC techniques will be useful in identifying the exact nature of various electrically defects observed in EBIC images. Also, a more detailed study to establish correlation of the measured I-V characteristics with the density and nature of the defects observed in EBIC measurements would provide information on the electrical characteristics of SiC/metal interface at localized defect sites.

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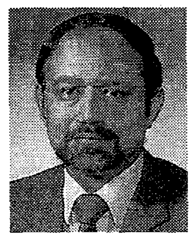

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H. R. Kirk, photograph and biography not available at the time of publication.

G. A. Rozgonyi, photograph and biography not available at the time of publication.