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Influence of Beta Irradiation on the Electrical Characteristics of Nano-MPS Structure Schottky Diodes

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Keywords

Beta Radiation
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Abstract

In this study, the changes in the fundamental electrical parameters of Au/PVA(5% Graphene doped)/n-Si/Au (MPS) Schottky diodes produced by the electro-spin coating method were investigated when exposed to beta radiation. Current-voltage (*I-V*) and capacitance-voltage (*C-V*) measurements were taken at a frequency of 1 MHz, before and after (20 kGy) beta radiation. As the radiation source, a ^{90}Sr (Strontium-90) Beta (β) source with a dose rate of 22 mGy per hour was used. Using *I-V* measurements, electrical parameters such as reverse saturation current (I_0), ideality factor (n), zero bias barrier height (Φ_{B0}), rectification ratio (RR), series resistance (R_s), and short circuit resistance (R_{sh}) were calculated. When radiation is applied, the R_s and leakage current values decrease, while the R_{sh} and RR values increase, indicating that the structure possesses ideal diode characteristics and is resistant to radiation. Interface state density (N_{ss}), an important parameter attained from *I-V* measurements, was also calculated. The calculated N_{ss} value is on the order of ~10^{13} $eV^{-1}cm^{-2}$, and this value is not large enough to impair device performance. In inculusion, the fundamental electrical parameters such as the diffusion potential of the diode (V_D), the density of the transmitter additive atoms (N_D), Fermi energy (E_F), maximum electric field (E_m), consumption layer width (W_D) and barrier height ($\Phi_{B(CV)}$) were calculated from *C-V* measurements. When radiation was applied, the V_D, N_D, E_m, and $\Phi_{B(CV)}$ values declined, while the E_F and W_D values raised. According to the findings, when the produced MPS structure was exposed to beta radiation, a decline/raise occurred in its electrical parameters. It was concluded that these decline/raise did not have an effect that would impair diode performance. For all these reasons, it has been concluded that PVA (5% Graphene doped) interfacial polymer material is an ideal material for obtaining radiation resistant and high-quality Schottky diodes.

Cite

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1. INTRODUCTION

Due to their durable, efficiency, and tiny size, organic semiconductors are used as ingredients of base circuit elements in electronics (Farazin et al., 2021). Metal/semiconductor (MS) Schottky barrier diodes (SBDs), which are between the circuit elements, have an growing significance in today's technology due to their ability to switch fastly at low voltages and their rectifier properties. To get loud-performance and loud-quality Schottky diodes, it is requiste to ensure there are no defects in the metal and semiconductor, the metal and semiconductor surfaces are free from dirt, and the ohmic and Schottky contacts are of high quality (Rhoderick

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GU J Sci, Part A | 13(3) 1119-1132 (2026) | 10.54287/gujsa.1961545

& Williams, 1988). The interface layer's quality and thickness play a significant role in the electrical characteristics of SDBs. A high quality SBDs should have a large barrier height, low leakage current, and a good rectification ratio for optimal performance and credibility.

When MS or metal-insulator/polymer-semiconductor (MIS/MPS) structures are exposed to radiation, numerous lattice defects develop. These defects, acting as recombination centers or minority/majority carriers, cause decay in diode yield. Da Silva et al. (1987), Ma (1989) and Winokur et al. (1976) were the first researchers to investigate the after radiation attitude of radiation induced N_{ss} at the MS interface in MIS/MPS structures. These studies have examined two main effects of radiation: (a) a temporary influence owing to electron-hole pair formation and (b) a lastig influence causing changes in the crystal lattice. When radiation is applied, the resulting holes, being less mobile than electrons, propagate into the interface layer, give rise to the formation of numerous constant hole traps.

The interface layer is the most radiation-sensitive part of MIS/MPS type structures. In MIS/MPS structures, the interface layer affects electrical properties, thus any mechanism affecting the interface also affects the performance of such devices. Most radiation induced traps are localized around the insulator/Si interface. Charges and impurities formed at the insulator/Si interface shorten the radiation effect and provide long-term dependability in MS or MIS/MPS electronics.

In this study, poly(vinyl alcohol) (PVA) was used as the polymer material for the interface layer. PVA is preferred as an acceptable material for electronic circuit components thanks to its high charge storage capacity, flexibility, ease of production, low cost, and electro-optical properties that change with doping. It is possible to increase the electrical conductivity of PVA, which is an insulator, by doping it with conductive materials (such as graphene, nickel, cobalt, and zinc). Therefore, metal-doped PVA or other polymer materials can be used as interface layers to reduce interfacial diffusion between MS (Bhajantri et al., 2007). In this study, graphene, used as an additive, is a name given to the single-layer form of graphite. Graphene has been one of the most significant two-dimensional (2D) materials that has attracted the attention of researchers since its discovery, thanks to its wonderful electrical, mechanical, optical and thermal features. It possesses high physical properties such as adjustable bandwidth, ultra-superior charge carrier mobility, superior transparency, superior conductivity, and flexibility. Thanks to these properties, it is between the choose materials for electronic, optoelectronic, energy storage, and biomedical device applications.

By leveraging the superior properties of graphene (Gr) and PVA described above, it was aimed to obtain the MPS structure using 5% graphene doped PVA (PVA (5% Gr)) as the interface polymer material. Furthermore, the fundamental diode parameters (n, RR, Φ_{B0}, R_s, R_{sh}, E_F, E_m, W_D, N_D, and $\Phi_{B(CV)}$) were calculated from I-V and C-V measurements performed on the fabricated MPS structure before and after (20 kGy) beta radiation. This study was conducted to investigate whether these calculated diode parameters preserve/not preserve the ideal Schottky diode structure under radiation. A PVA (5% Gr) interface layer was grown on the surface of an

GU J Sci, Part A | 13(3) 1119-1132 (2026) | 10.54287/gujsa.1961545

n-Si semiconductor using electro-spin coating method. The measurements of the fabricated diodes were performed at 1 MHz frequency and at room conditions. The MPS structure was exposed to 20 kGy of radiation from an ^{90}Sr β-radiation source with an intensity of 22 mGy/hr. From the *I-V* measurements, I_0, n, RR, Φ_{B0}, R_s, R_{sh}, and N_{ss} values were calculated. In addition, the parameters V_o, V_D, E_F, N_D, E_m, and $\Phi_{B(CV)}$ are calculated from the *C-V* measurements

2. MATERIAL AND METHOD

As an n-Si semiconductor substrate, a (100) oriented, 2 inch diameter, 350 µm thick and $4.3x10^{15}$ cm^{-3} phosphor (P) doped substrate was used. A chemical cleaning method was applied to uninstall the oxide layer formed on the n-Si surface and organic/inorganic contaminants. For this purpose, the n-Si semiconductor was washed in an ultrasonic bath with Ammonium Peroxide ($(NH_4)_2O_2$) for 40 s, and then rinsed with deionized water in the same ultrasonic bath for 5 minutes. Immediately afterwards, it was ultrasonically cleaned for 1 minute in both $H_2O+H_2O_2+H_2SO_4$ (1:1:3) and HCI+H_2O (1:1) solutions. After rinsing again in deionized water for 10 min, it was dried using dry nitrogen gas(N_2). It was placed in a high-vacuum (~10^{-6} Torr) thermal vaporization system to form ohmic contacts (Figure 1a). A 150 nm thick layer of gold (Au; 99.995% purity) was vaporized onto the back (matte) surface of the cleaned n-Si semiconductor substrate. To receive low-resistance ohmic contacts, annealing was performed at 500 °C (3 min) under N_2 gas. The prepared PVA (5% Gr) mixture was coated onto the bright (front) surface of the n-Si substrates using electro-spin coating method. The sample was repositioned in the metal evaporation system by placing a copper mask, 1.0 mm thick and 2 inches (5.08 cm) in diameter, onto the front surface of the structure and then placing the sample in the sample holder. In the thermal evaporation system, gold with a thickness of 150 nm was vaporized to form rectifier contacts. Thus, the manufacturing of MPS structure was completed, and a schematic representation of the MPS structure is given in Figure 1b. *I-V* measurements of the fabricated diode were taken with a Keithley 2400 SourceMeter, 1while *C-V* measurements were taken with a 4192A LF impedance analyzer. All measurements were fulfilled before and after (20 kGy) beta radiation using an ac/dc converter card connected to a computer.

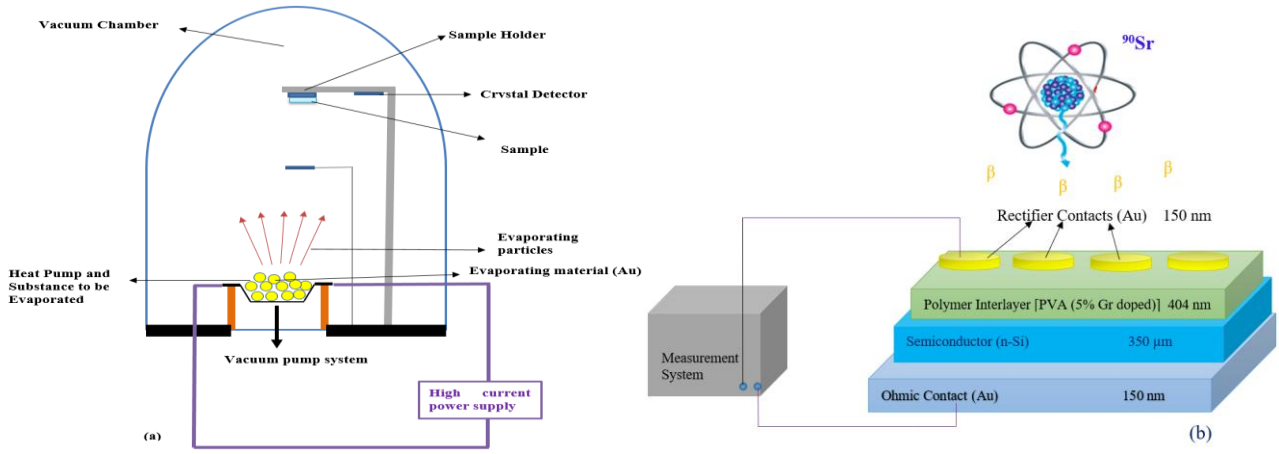


Figure 1. a) *An example of a thermal vaporization system,* ***b)*** *Cross-sectional view of Au/PVA (5% Gr)/n-Si (MPS) Schottky diodes and block diagram of the measurement system*

GU J Sci, Part A | 13(3) 1119-1132 (2026) | 10.54287/gujsa.1961545

3. RESULTS AND DISCUSSION

3.1. Structural Analysis of the Interface

Figure 2a-2b shows Scanning electron microscopy (SEM) images (FE-SEM, Hitachi SU8700) of graphene and PVA powders, respectively. Energy-dispersive X-ray spectroscopy (EDX) was used to examine the purity and stoichiometry of the graphene and PVA powders. Figure 2a-2b indicates the carbon (C) and oxygen (O) elements for graphene and PVA powders. The reason why hydrogen (H) atoms are absent from these profiles is because of the lightweight of the hydrogen atom. The other elements in this profile are related to the substrate elements. In Figure 2a, the percentages of carbon and oxygen atoms in the graphene composition are 94.8% and 4.5%, respectively. In Figure 2b, the PVA composition contains 68.9% carbon (C) and 30.2% oxygen (O) atoms, in order. Figure 2c shows that the SEM image of PVA (5% Gr) does not have a smooth surface.

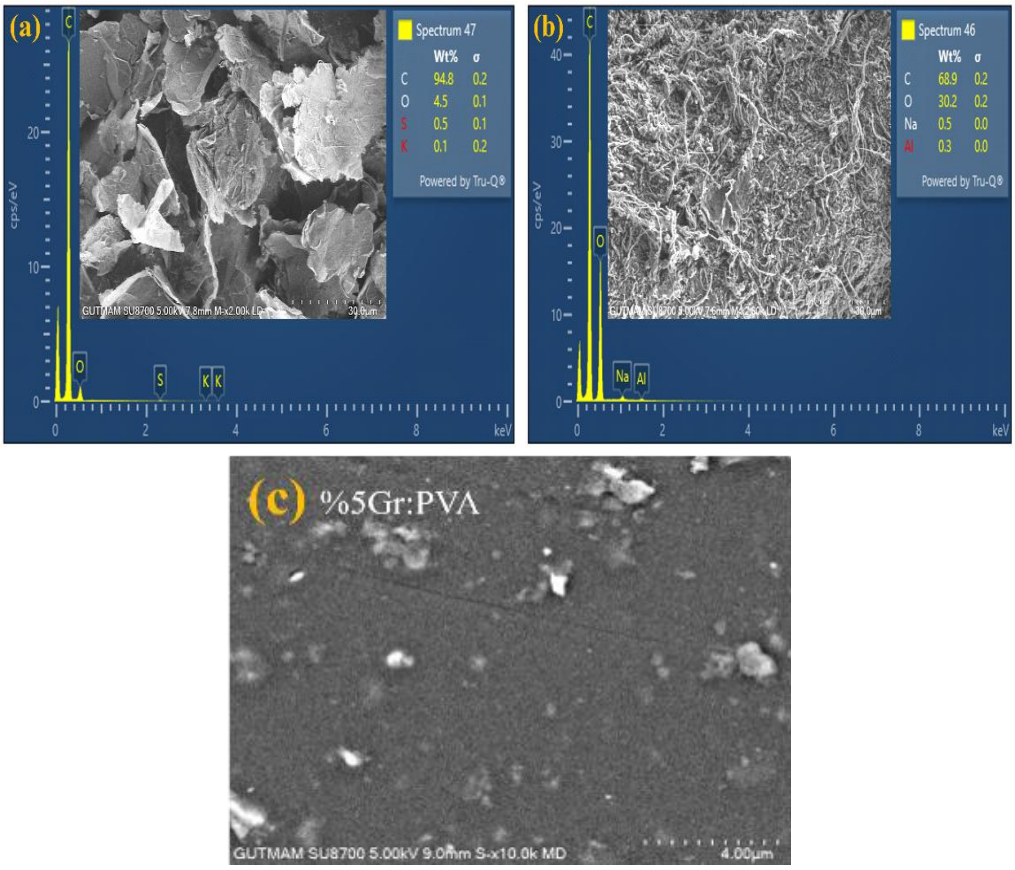


Figure 2. *FE-SEM images and EDX spectras of* ***a)*** *graphene powder,* ***b)*** *PVA powder, and FE-SEM image of* ***c)*** *PVA (5% Gr)*

3.2. Result of Measurement

To accurately and comprehensively mean the effects of radiation on SBDs, it is necessary to take and analyze different measurements before and after radiation. In this study, both *I-V* and *C-V* measurements of MPS structure were obtained, and these measurements were analysed using various methods.

Figure 3 shows the *ln*(*I*) vs. *V* curve for positive and reverse bias voltages, before and after (20 kGy) beta radiation.

GU J Sci, Part A | 13(3) 1119-1132 (2026) | 10.54287/gujsa.1961545

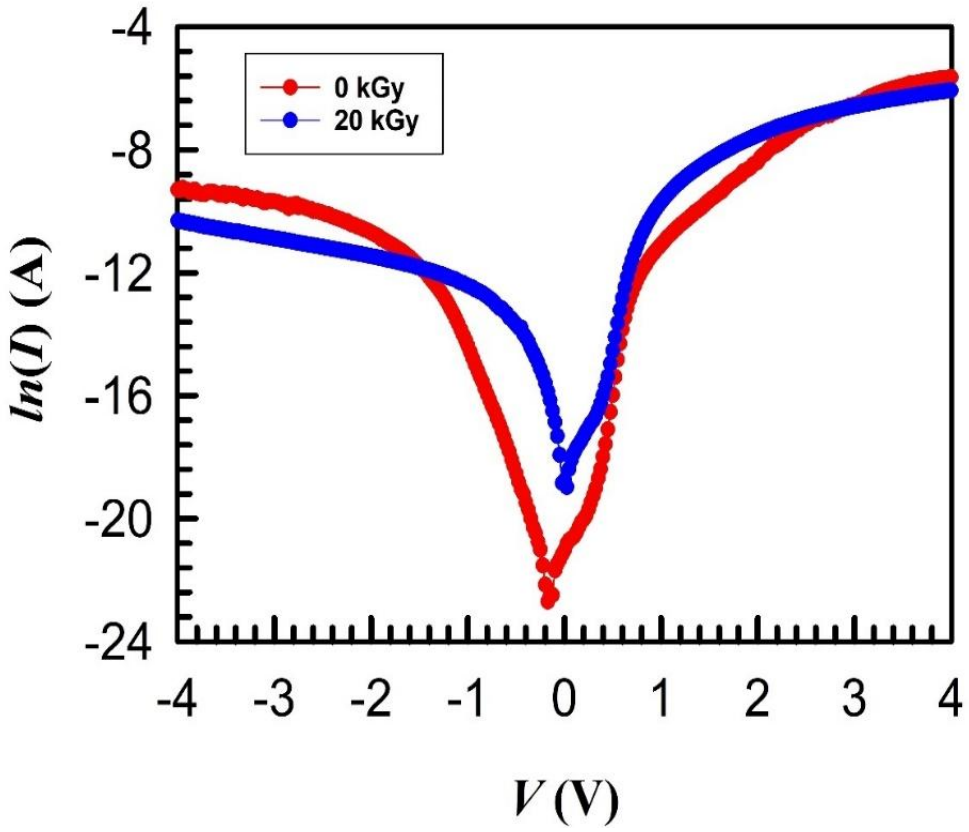


Figure 3. *ln(I)-V curve of MPS structure*

Figure 3 shows that a change in current value occurs when radiation is applied to the MPS structure. When 20 kGy of beta radiation was applied, decrease in reverse supply current (-4V = leakage current) occurred. This shows that applying 20 kGy of beta radiation causes a partial improvement in the MPS structure. In universal, any increase in reverse feed currents is associated with the emergence of new charge carriers and defects near the semiconductor (Dixit et al., 2007). Because these defects provide new paths for charge carriers, thus causing an increase in currents. Also, both the reduced in Φ_{B0} occurring in the metal region and the recombination centers near the semiconductor may be the reason for these raises (Dökme et al., 2008). In feed forward currents, the current is observed to increase when radiation is applied. But, the presence of R_s, which restricts current flow, caused a bending in the *I-V* curve in the positive bias voltage.

In MIS/MPS type SBDs, if the n is huger than 1 and the diode has an R_s value, the current and voltage relationship under true bias ($V \geq 3kT/q$) is expressed by Eq. 1. According to TE theory, the semilogarithmic current of the diode exhibits linear behavior as a function of voltage between 3kT/q and the midle voltage (~0.5-0.7 V) region. This linearity deviates due to *Rs* as we move towards sufficiently high positive voltages (Krishnan et al., 2008).

But, to complete understand the causes of these raises and declines it is essential to get diode parameters such as I_0, n, and Φ_{B0}. These parameters can be obtained from the linear region of the forward bias voltage $ln(I)$-V graphs (Figure 4).

GU J Sci, Part A | 13(3) 1119-1132 (2026) | 10.54287/gujsa.1961545

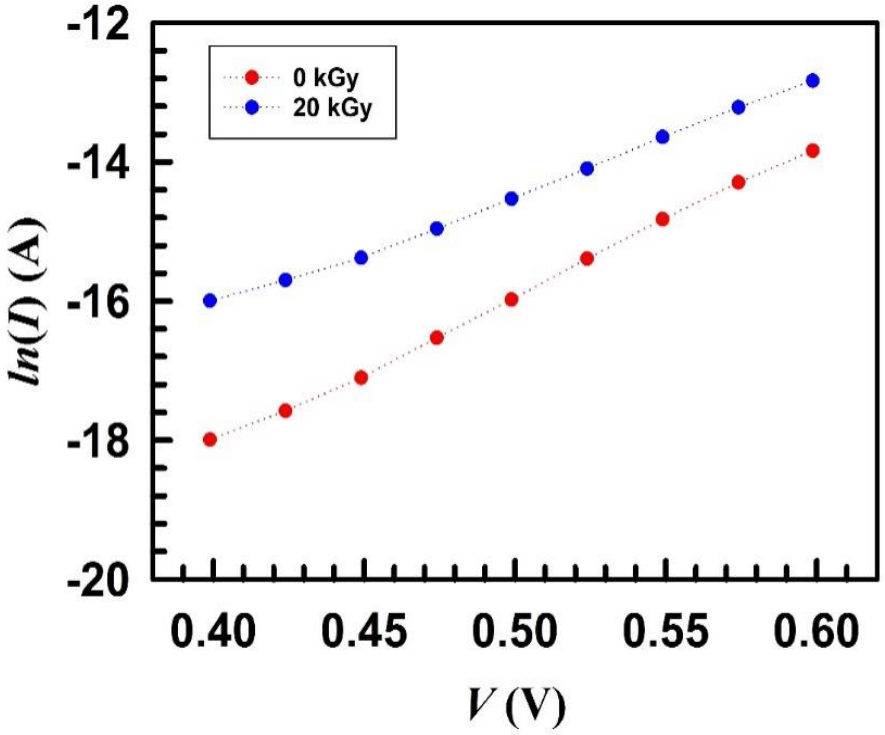


Figure 4. *Linear region of the ln(I)-V graph of MPS structure*

$$I(V) = I_0\left[\exp\left(\frac{q(V - IR_s)}{nkT}\right)\right] \quad (1)$$

Here V, k, T, R_s, and IR_s ($=VR_s$) are the quantities representing the voltage applied to the structure, the Boltzmann constant (k=1.38x10^{-23}J K^{-1}), the temperature in Kelvin, the series resistance, and series resistance voltage.

The reverse supply saturation current (I_o) actually means the current drawn by the diode at zero bias voltage is expressed by Eq. 2.

$$I_0 = AA^*T^2\exp(\frac{-q\Phi_{B0}}{kT}) \quad (2)$$

Here Φ_{B0}, A(=7,85x10^{-3} cm^2 in this study), A*(112 A/cm^{2}K^2 for n-Si) are zero feed barrier height, rectifier contact area, and Richardson constant, respectively. The value of n is;

$$\mathrm{n} = \frac{\mathrm{q}}{\mathrm{kT}}\left[\frac{\mathrm{d(V)}}{\mathrm{d(ln\,I)}}\right] = \frac{q}{\mathrm{kT}.tan(\theta)} \quad (3)$$

If the ideality factor is ~1, that is, if the slopes of the $ln(I)$-V curves in the medium voltage region are equal to the thermal energy (kT/q) in the true bias region, this is known in the literature as ideal TE theory. Using Eqs. 1 and 2, the reverse saturation current (I_o) is obtained from the point where the extension of the linear region of the feedforward $ln(I)$-V graph (Figure 4) intersects the current axis. At the same time, the n value can be calculated from the slope of the linear region of the same graph. Furthermore, the Φ_{BO} value is obtained using Eq. 4.

GU J Sci, Part A | 13(3) 1119-1132 (2026) | 10.54287/gujsa.1961545

$$\Phi_{B0} = \frac{kT}{q} \ln\left(\frac{AA^{*}T^{2}}{I_0}\right) \quad (4)$$

In MIS/MPS type SBDs, the barrier (qV_i) encountered by the charge carriers (electrons and holes) that ensure conductivity/current when passing from semiconductor to metal (for n-type semiconductor diodes) is roughly one E_F energy level lower than when passing from metal to semiconductor. For this situation, at sufficiently high bias voltage values, the current drawn from the diode must be much greater than that of the reverse bias, and in ideal diodes, this ratio (I_F/I_R) is greater than 10^9. This is possible when the diode's series resistance approaches zero and its short-circuit resistance approaches 10^9 Ω. In other words, one of the factors that determines diode' s quality is the rectification ratio ($RR = I_F / I_R$). This ratio is the ratio of the current flowing through the diode under positive voltage (I_F) to the current flowing under reverse voltage (I_R). The *RR* value were calculated using the *I-V* curve and are shown in Table 1 below.

Table 1. *Fundamental diode parameters obtained from the I-V curve for Au/PVA (5% Gr)/n-Si (MPS) SBDs*

	FUNDAMENTAL ELECTRICAL PARAMETERS						
Beta Radiation	***n***	***I₀* (A)**	***Φ*$_{B0}$(eV)**	***Leakage Current* (-4 V)**	***RR* ±4 V**	***R*$_s$ (kΩ)**	***R*$_{sh}$ (kΩ)**
O kGy	1.86	0.03×10^{-10}	0.948	9.19×10^{-5}	38.71	23.1	38.7
20 kGy	2.45	1.52×10^{-10}	0.847	3.35×10^{-5}	69.58	6.25	69.6

As seen in Table 1, *n*, I_o, Φ_{Bo}, and *RR* values vary depending on the radiation. While the values of *n*, I_o ve *RR* raising with radiation application, the other value, Φ_{Bo} decreases. For the MPS structure, the value of *n* was obtained to greater than 1. This is thanks to current/transmission mechanisms' s presence such as diffusion, recombination, and Gaussian distribution in barrier height, along with thermionic emission (TE) theory. Consequently, the great n values attained before and after radiation are indicative of a deflection from the TE theory. By Gaussian distribution theory, carriers that do not have sufficient energy to overcome the barrier can pass through numerous obstacles/paths located in regions close to the average barrier height. This situation resuilt in an increase in the current and ideality factors. When beta radiation is applied to the MPS structure, the defects formed at the interface act as trap and recombination centers. When radiation is applied, the increase in these defects' s intensity leads to nonuniformity at the interface, lead to increment in *n* (Krishnan et al., 2008).

When beta radiation was applied, decrease in Φ_{Bo} values occurred. Researchers attribute this to the fact that beta radiation causes defects to form on the semiconductor's surface, which in turn affects the free carrier density. This situation causes increases or decreases in barrier height with the application of radiation (Fonash et al., 1981).

GU J Sci, Part A | 13(3) 1119-1132 (2026) | 10.54287/gujsa.1961545

Reverse saturation current (I_o) values increased when we applied beta radiation to the MPS structure. From this, it can be said that beta radiation reduces the formation of free carriers, and this plays an important role in *I-V* characteristics. Any raising or lowering in the I_0 value is associated with the deep level traps acting as a recombination centre. Moreover, reductions in barrier height can have to increase in reverse saturation current (Teffafi et al., 2016).

One of the parameters that have to be examined to realise and evaluate the effects of radiation is the density of interface states. Using *I-V* data at positive voltage, the energy-dependent (E_c-E_{ss}) distribution of the semiconductor N_{ss} was calculated. The *Nss* value was obtained by considering the voltage-dependent exchage of both the barrier height $\Phi e(V)$ and the ideality factor *n(V).* The *n(V)* ve $\Phi_e(V)$ values can be calculated using Eqs 5 and 6, respectively, when the R_s values are neglected. Accordingly, the formula N_{ss} obtained by considering $n(V)$ and $\Phi e(V)$ is given by Eq. 7. Furthermore, the energy distribution (E_c-E_{ss}) from the middle gap (E_{ss}) of semiconductor's band gap to the lower edge (E_c) of the conduction band is given by Eq. 8. In these formulas, ε_s and ε_i correspond to the dielectric constants of the semiconductor and the interface layer, correspondingly, the thickness of the d_i (=404 nm) polymer layer and the width of the W_D depletion layer.

$$n(V) = \frac{q}{kT}\left(\frac{V}{\ln\left(\frac{I}{I_0}\right)}\right) = 1 + \frac{d_i}{\varepsilon_i}\left[\frac{\varepsilon_s}{W_D} + qN_{ss}\right] \tag{5}$$

$$\Phi_{\mathrm{e}}(\mathrm{V}) = \Phi_{\mathrm{B0}} + \left(1 - \frac{1}{n(V)}\right)V \tag{6}$$

$$N_{ss}\,(V) = \frac{1}{q}\left[\frac{\varepsilon_i}{d_i}(n(V) - 1) - \frac{\varepsilon_s}{W_D}\right] \tag{7}$$

$$E_c - E_{ss} = q(\Phi_{\mathrm{e}} - V) \tag{8}$$

The N_{ss}-(E_c-E_{ss}) curve of the prepared MPS structure is given in Figure 5.

In ideal semiconductors, the N_{ss} value is approximately of ~10^{12} eV^{-1} cm^{-2}. As seen in Figure 5, the N_{ss} values increase from the middle of the forbidden energy band towards the lower edge of E_c. The obtained average N_{ss} values are approximately 10^{13} eV^{-1} cm^{-2}, and although there is a small deflection from the ideal situation, this value is suitable for a semiconductor device (Sevgili et al., 2025).

One of the crucial parameters to examine to identify radiation-induced defects in semiconductor materials is their resistance values. The voltage-dependent graph of resistance values (R_i) before and after beta radiation was obtained and is given in Figure 6. From the measured I-V values, R_i vs. V is obtained using Ohm's law. To assess the transition in R_{sh} and R_s, the R_i value was taken as a semi-logarithmic value, and the change of R_i vs. V is shown in Figure 6.

GU J Sci, Part A | 13(3) 1119-1132 (2026) | 10.54287/gujsa.1961545

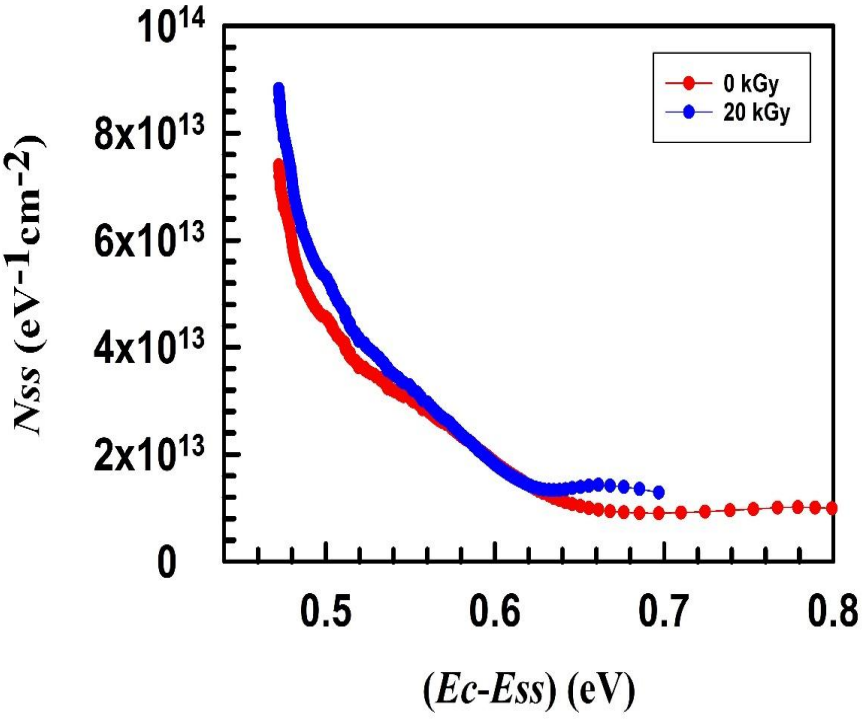


Figure 5. *N_{ss} vs. (E_c-E_{ss}) graph of Au/PVA (5% Gr)/n-Si (MPS) structure*

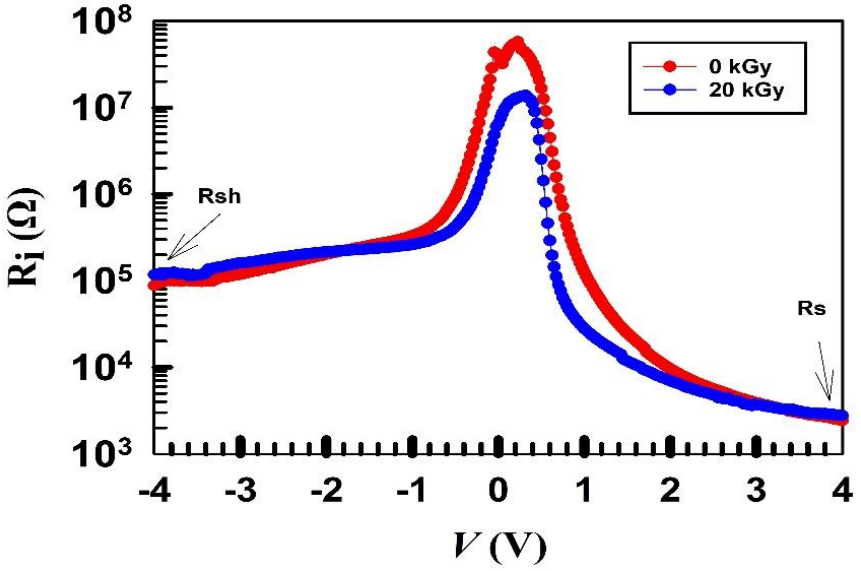


Figure 6. *R_i-V curve of MPS structure*

In Figure 6, the actual R_s and R_{sh} values are resistance values corresponding to +4V and -4V, respectively. Table 1 shows the R_s and R_{sh} values obtained before and after beta radiation. When beta radiation was applied to the MPS structure, a decrease *Rs* values and an raise in R_{sh} values occurred. In the end, the decline in R_s values and the raise in R_{sh} values when radiation is shows that the diode has an ideal structure. This situation has been attributed to the fact that the rectification ratio (*RR*) of the diode increases when radiation is applied to the MPS structure, which proves this result (Güçlü et al., 2026).

The *C-V* graph attained from the *C-V* measurements of the MPS structure is shown in Figure 7.

GU J Sci, Part A | 13(3) 1119-1132 (2026) | 10.54287/gujsa.1961545

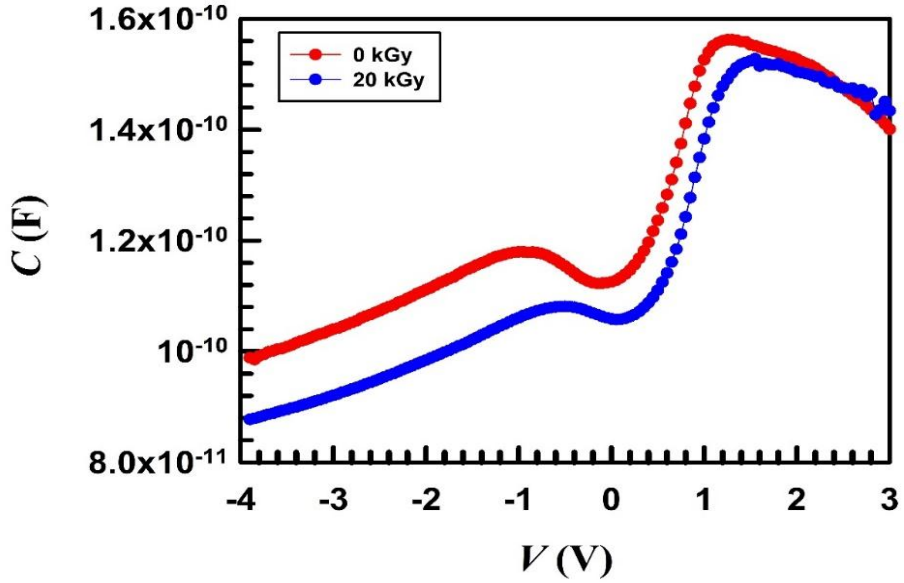


Figure 7. *C-V curve of Au/PVA (5% Gr)/n-Si (MPS) structure*

From the linear region of the $1/C^2$-V graph (Figure 8b), the fundamental electrical parameters such as diffusion potential (V_D=V_o+kT/q), the density of the donor-doped atoms (N_D), Fermi energy level (E_F), the width of the depletion layer (W_D), and barrier height ($\Phi_{B(CV)}$) were obtained at the zero bias voltage value. These parameters were received using the following equations, taking advantage of the intersection point (=Vo) and slopes of the linear region, and the results are given in Table 2.

$$C^{-2} = \frac{2}{q\varepsilon_s\varepsilon_0 A^2 N_D}(V_D + V_R) \tag{9}$$

In Eq. 9, the values V_R, ε_s (=11.8ε_0), and ε_0 (=8.85×10^{-14} F/cm) are the reverse bias voltage, the dielectric constant of the semiconductor, and the dielectric constant of the free space. The Fermi energy level (E_F) is given by Eq. 10.

$$E_F = \frac{kT}{q}\ln\left(\frac{N_C}{N_D}\right) \text{and Nc} = 4.82\text{x}10^{15}\ T^{3/2}(m_e^*/m_0)^{3/2} \tag{10}$$

Here, Nc (for n-Si, Nc=2.8x10^{25} m^{-3}), m_e^* ($= 0.98\, m_0$), and m_0 (=9.1x10^{-31} kg) values are the density of the allowed energy states in the conduction band, the effective mass of the electron, and the mass of the electron**.** In addition, the electrical parameters N_D, E_m, W_D, and $\Phi_{B(CV)}$ were calculated using Eqs. 11-14.

$$N_D = \frac{2}{q\ \varepsilon_s\ \varepsilon_0\ A^2\ tan\theta} \tag{11}$$

$$E_m = \left(\frac{2qN_D V_0}{\varepsilon_s\varepsilon_0}\right)^{\frac{1}{2}} \tag{12}$$

GU J Sci, Part A | 13(3) 1119-1132 (2026) | 10.54287/gujsa.1961545

$$W_D = \sqrt{\frac{2\varepsilon_S\varepsilon_0 V_0}{qN_D}} \tag{13}$$

$$\Phi_{B(C-V)} = V_0 + \frac{kT}{q} + E_F = V_D + E_F \tag{14}$$

$$c_2 = \frac{N_{Dexp}}{N_{Dteo}} \tag{15}$$

One of the points to be considered when making calculations is that when the cutoff voltage (V_0) is huge than the forbidden energy band gap of the semiconductor, a correction factor (c_2) should be added to these formulas. In such a case, c_2V_0 should be used instead of V_0 in the formulas given above. In Eq. 15, the correction factor (c_2) is obtained by dividing the theoretical value of donor-doped atoms (N_{Dteo}=8.62x10^{16} cm^{-3}) (Alptekin et al., 2025).

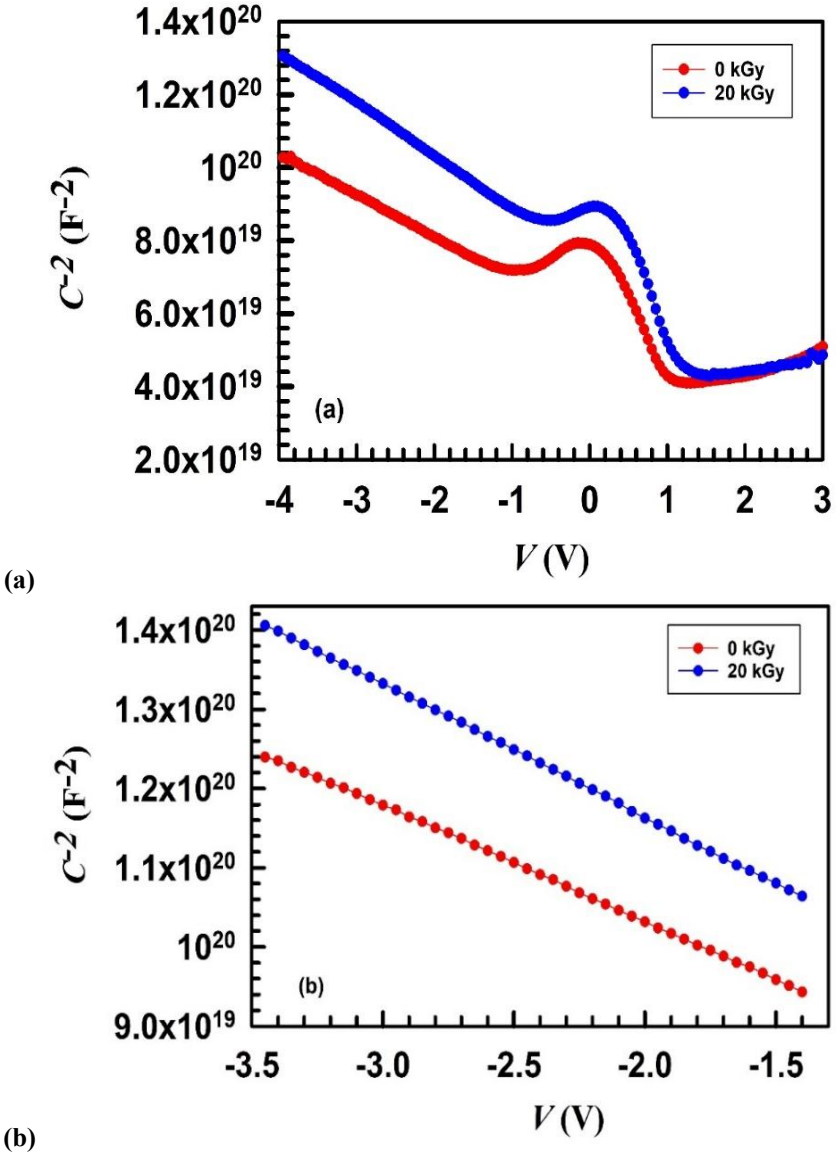


Figure 8. a) *1/C^2 vs V and,* ***b)*** *linear region graphs of MPS structure*

GU J Sci, Part A | 13(3) 1119-1132 (2026) | 10.54287/gujsa.1961545

Table 2. *Fundamental electrical parameters attained from the C-V curve for Au/PVA (5% Gr)/n-Si (MPS) SBDs*

Beta Radiation	FUNDAMENTAL ELECTRICAL PARAMETERS							
	c_2	V_o (eV)	V_D (eV)	N_D (cm^{-3})	E_F (eV)	W_D (cm)	E_m (V/cm)	$\Phi_{B(CV)}$ (eV)
0 kGy	0.154	0.782	0.807	$1.33x10^{16}$	0.191	$2.770\ x10^{-5}$	$5.65x10^{4}$	0.99
20 kGy	0.134	0.661	0.686	$1.16x10^{16}$	1.195	$2.773\ x10^{-5}$	$4.84x10^{4}$	0.88

The electrical parameters were calculated using the slope of the linear region of the $1/C^2$ vs. V graph given in Figure 8a-8b and the point where it intersects the voltage axis. According to the calculations, V_D, N_D, E_m, and $\Phi_{B(CV)}$ values decrease due to radiation, while E_F and W_D increase. Moreover the increase in the slope of the linear region when radiation was applied caused a decrease in the N_D value. In this sense, low slope values can be attributed to the presence of the additional capacitance arising from interface conditions. Due to the effect of N_D radiation, the value decreased from $1.33x10^{16}$ cm^{-3} to $1.16\ x10^{16}$ cm^{-3}. This decrease in donor atom density is a result of recombination in traps at the PVA(5% Gr)/Si interface. Due to the effect of radiation, the $\Phi_{B(CV)}$ value declined from 0.99 eV to 0.88 eV because of the decline in the V_0 value.

It is significant to note that the Φ_B values calculated from *I-V* and *C-V* measurements are distinct from each other. The Φ_B values attained from *C-V* are greather than the values attained from *I-V*. This is because the *I-V* method involves the flow of the electrons from the semiconductor to the metal, and the current conduction mechanism is calculated based on TE mechanism.

4. CONCLUSION

In this study, Au/PVA(5% Gr)/n-Si (MPS) Schottky diodes with a PVA (5% Gr) polymer interface were fabricated. Fundamental electrical parameters were calculated by taking I-V and C-V measurements before and after (20 kGy) beta radiation was applied to the produced MPS structure. Using I-V measurements of the MPS structure, leakage current, ΦB0, and Rs values decreased while n, I0, RR, and Rsh values increased. An increase in the values of Io and n shows deflection from the standard TE theory. Additionally, when radiation was applied, the Rs and leakage current values decreased, while the Rsh and RR values increased. This demonstrated that the MPS structure was radiation-resistant and exhibited behavior close to an ideal diode. The Nss value calculated from I-V measurements is on the order of ~1013 eV-1cm-2, which is a magnitude that will not impair the semiconductor's performance. Fundamental electrical parameters of the Schottky diode, such as VD, ND, EF, Em, WD, and ΦB(CV), were calculated from C-V measurements. When radiation was applied, VD, ND, Em, ΦB(CV) values decreased, while EF, WD values increased. In the end, applying beta radiation to the MPS structure resulted in an increase/decrease in its electrical parameters, but it was determined that it did not have an effect that would impair diode performance. The PVA (5% Gr) interface polymer material used in MPS structures has been found to be an ideal material for obtaining radiation resistant and high quality Schottky diodes.

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AUTHOR CONTRIBUTIONS

Ö.A.: Conceptualization, Methodology, Software, Verification of experimental results, Content analysis, Research, Article writing. **S.B.O.:** Article Writing, Review and Editing, Consultancy/Supervision.

AI Exclusion: AI tools are strictly prohibited from being listed as authors.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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