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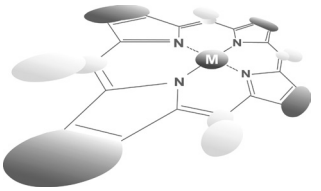

# Schottky barrier diode parameters of Ag/MgPc/p-Si structure

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*Dedicated to Professor Tebello Nyokong on the occasion of her 60th birthday*

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**ABSTRACT:** An Ag/Pc/p-Si Schottky barrier (SB) diode was fabricated. The current-voltage (I-V), capacitance-voltage (C-V) and conductance-voltage (G-V) measurements were carried out to determine the characteristic parameters such as barrier height, ideality factor and series resistance of the SB diode. The non-linear behavior of ln (I) *vs.* ln (V) and ln (I/V) *vs.* $V^{1/2}$ plots indicated that the thermoionic emission theory can be applied to evaluate junction parameters for the investigated SB diode rather than space-charge limited conduction (SCLC) mechanism and bulk-limited Poole–Frenkel emission. The bulk doping concentration $N_B$ and fixed oxide charges $N_f$ was determined from the measured high frequency C-V curve and was found to be $9.5 \times 10^{14}$ $cm^{-3}$ and $2.3 \times 10^{13}$ $cm^{-2}$, respectively. The values of barrier height obtained from Norde's function were compared with those from the forward bias current-voltage characteristic, and it was seen that there was a good agreement between barrier heights from both methods.

**KEYWORDS:** fixed oxide charge, MIS structure, interface trap, nonperiferally position, ball type MgPc.





## INTRODUCTION

As a member of organic semiconductors, phthalocyanines (Pcs), which combine the electrical properties of conventional inorganic semiconductors and the versatility of organic chemistry, have attracted much attention. Due to their high chemical stability, various possible synthetic modifications without altering their chemical stability, ability to form well-ordered thin films and wide absorption within the optical region, it is possible to produce devices such as light emitting diodes (LEDs), field effect transistors (FET) and solar cells, with performances approaching their inorganic counterparts [1–4]. In recent years, the applicability of the Pc compounds in metal-insulator-semiconductor (MIS) based devices has been studied in some detail by various workers. Pakhomov *et al.* [5] obtained MIS type Schottky barrier (SB) diode by standard vacuum sublimation of lead phthalocyanine (PcPb) and copper hexadecachlorophthalocyanine ($Cl_{16}PcCu$) organic thin films on a semiconductor substrate. Subsequently they attached different metal contacts (Pb and Au), by evaporation, and then measured the theoretical Schottky coefficient and the barrier height $\Phi_B$. They concluded that the type of conductivity in Pc layer affects the rectifying behavior of such heterostructures, rather than the metal material used as top contact. Electrical transport mechanisms and photovoltaic characterization of cobalt phthalocyanine on silicon heterojunctions have been studied in the dark and under illumination by Soliman *et al.* [6]. They concluded that the forward current

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