**Physico-Chemical Nanomaterials Science**

**Effectuality of Interlayer Thicknesses on Dielectric Qualifications of Metal-Semiconductor Structures**

**Arslan B. 1, Tan S.O.2\*, Tecimer H.2, Altındal Ş.3**

*1 Department of Electrical and Electronics Engineering, Faculty of Engineering, Karabuk University, Karabuk, 78050, Turkey.*

*2 Department of Electrical Engineering, Faculty of Technology, Karabük University, Karabük, 78050, Turkey.*

*\*E-mail:* [*serhatorkuntan@karabuk.edu.tr*](mailto:serhatorkuntan@karabuk.edu.tr)

*3Department of Physics, Faculty of Sciences, Gazi University, Ankara, 06560, Turkey.*

Metal / semiconductor systems are used in many important applications such as phototransistors, space solar cells, microwave field effect transistors, quantum confinement devices and radio frequency detectors in the electronics industry [1]. The performance of the metal-semiconductor contact is highly affected by the interlayer quality at MS surface [2]. Therefore, the fabrication of MS structures with inorganic interlayer (MIS) and organic polymer interlayer (MPS) has gained importance at scientific community. Ideally, for a Metal-Insulator-Semiconductor (MIS) or Metal-Polymer-Semiconductor (MPS) type semiconductor device, the capacitance and conductance (C and G/ω) values ​​are expected to be frequency independent and increase with increasing voltage [3]. Therefore, the same situation is expected for the values ​​of dielectric constant (ε') and dielectric loss (ε'') [4].

In this study, the dielectric properties of MS structures without interlayer and with Al2O3 interlayer have been investigated in a wide frequency range under forward and reverse biases. In this context, parameters such as loss tangent (tanδ), dielectric constant (ε'), dielectric loss (ε'') were calculated from the capacitance and conductivity data. The observed changes in dielectric parameters have been attributed to the coupling mechanisms between charges placed at the interface states, surface and bipolar polarization, and traps. The experimental results clearly indicate that the values of ε', ε'' and tanδ vary significantly with frequency and voltage. That is, the thickness of the interlayer changes considerably the dielectric properties of the structure. As a result, it has been revealed that the desired device properties can be achieved by varying the thickness of the interlayers.

1. *Soylu M., Abay B., Onganer Y.,* The effects of annealing on Au/pyronine-B/MD n-InP Schottky structure *//* J Phys Chem Solids.-2010.-*.* **71**, N 9.-P. 1398-1403.
2. *Biswas A., Sil S., Dey A., Datta J., Das D., Ray P. P.,* Investigation of conduction kinetics in Al/CuInSe2 Schottky device utilizing impedance spectroscopy (IS) measurement and study of its photo sensing behavior *//* J Phys Chem Solids.- 2021.- **150**, P. 109878.
3. *Sharma M., Tripathi S.K.,* Study of barrier inhomogeneities in I-V-T and C-V-T characteristics of Al/Al2O3/PVA:n-ZnSe metal-oxide-semiconductor diode //J. Appl. Phys.- 2012.-. **112**, P. 024521.
4. *Tan S. O.,* Identification of the frequency- and voltage-dependent dielectric characterization of metal-Zn/PVA-semiconductor structures *//* IEEE Trans. Nanotechnol.-2019.- **18**, P. 432-436.