Transparent In/SeO2 thin film transistors designed for gigahertz/ terahertz technologies

 A. F. Qasrawi 1,2,\*, Rana B. Daragme1

1. 1Department of Physics, Arab American University, Jenin, Palestine

2Department of Electrical and Electronics Engineering, Istinye University, 34010, Istanbul, Turkey

E-mail: atef.qasrawi@aaup.edu; atef.qasrawi@istinye.edu.tr

Researcher Id: <https://publons.com/researcher/R-4409-2019/>

Scopus ID: 6603962677

ORCID iDs: A F Qasrawi https://orcid.org/0000-0001-8193-6975

**Abstract**

Herein thin films of selenium oxide are coated onto transparent indium substrates of thickness of 150 nm under a vacuum pressure of 10-5 mbar. In/SeO2 optical receivers are structurally, optically and electrically characterized. Induced crystallization of tetragonal SeO2 showing homogeneous composition and continues film formation is achieved via indium substrates. Indium thin films enhanced the light absorbability and optical conductivity without altering the energy band gap of SeO2. Strong interaction between In and Se at the ultrathin interface of In/SeO2 forced formation of new second band gap of 0.92 eV relating to direct allowed transitions in InSe. Indium substrates increased the dielectric constant of SeO2 by more than four times making SeO2 suitable for nonlinear optical applications. The terahertz cutoff frequency changed in the range of 0.9-14.0 THz. Deep analysis of the optical conduction in In/SeO2 films has shown that the films display drift mobility, plasmon frequency and free carrier density values that nominate In/SeO2 for fabrication of thin film transistors. The transistors displayed microwave resonator features presented by double band stop filters. The filters showed return loss value larger than 20 dB and voltage standing wave rations of 1.0 at 1.16 GHz. Negative capacitance effect is also observed for the transistors under study.

Keywords: In/SeO2; high absorbance; negative capacitance; band stop filter; optical receiver

\* Author to whom any correspondence should be addressed.