The research and development in the field of organic photovoltaic have gained huge research interests recently. The organic solar cells have exhibited a power conversion efficiency (PCE) up to 12 % . Organic solar cells (OSCs) are very economical to produce by very cost effective and low temperature based chemical processes. In addition, OSCs can be fabricated as thin flexible films and hence require less amount of raw materials. However, OSCs have to overcome the two very important challenges before they can be commercialized: 1) power conversion efficiency (PCE) is still relatively lower than their inorganic counter parts, e.g., silicon solar cells and 2) poor stability or the problem of degradation with prolong exposure to sunlight. The problem 1 is being tackled with the structure of bulk heterojunction (BHJ) and gradually PCE of OSCs is increasing close to 12% . However, the problem of stability is less rigorously studied. As most organic materials degrade with long exposure to solar radiation, only possible solution appears to be the use of hybrid structure with inorganic materials.

This paper presents simulation of a hybrid structure of BHJ OSC with structure Glass/ITO/ PEDOT:PSS/PBDT-TS1:PCBM/Al and CZTS quantum dots (QDs) producing the hybrid cell with structure: Glass/ITO/ PEDOT:PSS/CZTS-QDs:PBDT-TS1:PCBM/Al. This structure with the incorporation of varying size of 11 CZTS QDs enhances the absorption and hence PCE to 16%. An improvement in stability is obtained by incorporating super-hydrophobic ZnO nanowires (NW) which also absorb the UV radiation before solar radiation reaches the active layer and hence increase the stability. The simulated proposed structure thus becomes ZnO-NW/Glass/ITO/ PEDOT:PSS/CZTS-QDs:PBDT-TS1:PCBM/Al and it also enhances PCE further to 16.9%. A detailed discussion on the proposed structure and resulting advantages will be presented in this talk.

## Surface plasmon resonance in $As_2Se_3$ planar waveguides for the IR spectral region

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The solid amorphous materials have some specific optical properties who cannot be finded in the crystalline state. One of the main phenomenon is photo-induced modification of optical constants (n, k), which can be used in various optoelectronic devices. Unfortunately, the changes, though largely dependent on the material, are not very large. This fact limits in many cases possible applications. An efficient solution to the problem consists in achieving a resonance structure, when small changes in optical constants lead to a considerable change in transmission or optical reflection. Such a structure would be the surface plasmon resonance, usually realized in Kretschmann configuration. So, the illumination of the As2S3 films in conditions of surface

plasmon resonance [1] led to changes in optical reflection of up to 50%.
The Kretschmann configuration requires coupling prism the refractive index of which is greater than that of the film deposited over the gold layer. In the case of chalcogenide materials, the refractive index ranges from 2.5 (for As2S3) to 3.0 (for As2Se3) and does not normally allow excitement of surface plasmonic resonance with a prism made of conventional optical glasses such as crown, flint etc. The situation can be overcomed if the film thickness is rigorously chose so that surface plasmon-polariton wave resonates with one of the waveguide modes. Some experimental studies were perform and published by using arsenic sulphide films. Although As2S3 is a high band gap material and permits the operation in visible light, it is not the most appropriate material with considerable photo-induced changes.

Of particular interest for optoelectronic applications is the 1.55 μm telecommunication spectrum, where the quartz optical fibers have the best optical transmission. In this IR spectral range other amorphous materials with a lower bandwidth and considerable photo-induction are preferred. In the paper we studied surface plasmon configuration with dielectric film made of amorphous As2Se3 film. The optical constants of the films were rigorously measured by ellipsometric and spectral transmission methods. Numerical simulations were made for the BK7-Gold-As2Se3-Air structure from which the thickness of the film needed to achieve surface plasmon resonance was established. Experimental study of resonance curves was done in the infrared field. Amorphous As2Se3 films were obtained by thermal vacuum deposition. The performance of this structure was evaluated experimentally.

**References**

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# Effect of indium and tin ion implantations on the properties of $Ge_2Sb_2Te_5$ thin films

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One of the most perspective electrical and optical non-volatile memory type is phase change memory (PCM) based on the chalcogenide materials, particularly on GST225 [1]. Introduction of dopants is an effective method for purposeful change of the GST225 properties,