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Mechanical,electronic and electrical properties of diamond-like carbon films grown by RF magnetron sputtering

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Diamond-like carbon (DLC) thin film is an amorphous carbon consisting of sp3 bonded and sp2 bonded carbon, and in addition contain up to several tens atomic percent of hydrogen. it can be used as protective anti – reflecting coatings for basic silicon solar cells to enhance the cell efficiency. On the other hand, it can be changed the opto-electronic and mechanical properties that depend on the sp3/sp2 fraction. Therefore in the work the opto -mechanical properties of DLC thin films by in situ control of the nucleation and growth of DLC thin films. Thus DLC thin films have been deposited on Si substrates using unbalanced RF magnetron sputtering at a constant power density of 4.4 W/cm2 and various substrate bias voltages in the range -25 to -100 V. Raman spectroscopy has been used to determine the sp3 fractions from the area ratios of the D-peak and G-peak (ID/IG). The results show that these ratio vary between (1.15-0.87) corresponding to sp3/sp2 ratio in the range (1.18-1.33). In addition, the hydrogen content were determined photoluminescence background in the range of (33.15-18.00) .The Tauc-gap and cluster size were determined by an empirical approach based the direct measurement in the range of (1.51-157eV) and (9.90-9.04 Å),respectively. The sheet resistivity were determined by using the expression of the Van der Pauw method in the range of (0.95-131× 102Ωcm). The elastics constant of DLC thin films were determined by surface Brillouin scattering and the optimum was determined at -100V. The thicknesses and the densities of the films have been determined to be (91-132 nm) and (2.20-2.35) using X-ray reflectivity, respectively.

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