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Deposition and Characterization of $CuAl_xB_{1-x}Se_2$ Thin Film Deposited by DC-RF Co-sputtering for Photovoltaic Application

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Solar cell has the potential of being the main drive to economic prosperity as it is one of the most promising sources of cheap, environmentally friendly and renewable energy. Crystalline silicon based technology currently dominate the solar energy market. However, it is generally expensive and the cell efficiency has reached 24.7% hence approaching theoretical expected maximum of 30%. In order to reduce cost of production, focus is shifting towards thin film based I-III-VI family chalcopyrite compounds where cheaper $CuIn_xGa_{1-x}Se_2$ absorber semiconductor is reported to have attained the highest efficiency of 20.3 %. This study intends to fabricate and characterize a compound of copper, aluminum, boron and selenium ($CuAl_xB_{1-x}Se_2$) thin film. The compound is based on I-III-IV family of chalcopyrite which has generated a lot of interest as an absorber material for solar cells due to their high absorption coefficients. The research procedure will involve deposition of $CuAl_xB_{1-x}Se_2$ thin film by DC and RF magnetron sputtering of CuAlB alloy and selenium targets respectively. The deposition is done using Edwards Auto 360 RF and DC magnetron vacuum system. Characterization of the resulting thin film based on structural and optoelectronic properties is done using X-Ray diffraction (XRD), X-Ray photoelectron spectroscopy (XPS), Scanning Electron microscopy (SEM), UV-Visible-IR Spectrometer, and the Hall Effect. The outcome of this research will provide fundamental practical science and engineering knowledge base on structural and optoelectronic properties of $CuAl_xB_{1-x}Se_2$ compound as solar absorber material among other optoelectronic applications. In general the study will contribute towards achieving greater efficiency in production of "green" energy.