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DEPO / Plasma - deposited coatings for optical, electronical and other functionalities

DIRECT OBSERVATION OF TWINNING DOMAINS IN COPPER IODIDE THIN FILM SYNTHESIZED BY MAGNETRON SPUTTERING OF CU THIN LAYERS AT LOW TEMPERATURE AND IODINE VAPOR

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Abstract content

Copper iodide (CuI) is attracting much attention for thin film applications, due to promising properties for optoelectronic devices and wide band-gap semiconductors. This non-toxic material is composed of earth abundant elements. Recently, it has been shown that CuI can be bonded with organic ligands used in perovskite solar cells. Depending on the temperature, copper iodide can crystallize in three structures named α, β, and γ-CuI. At room temperature, the more stable phase is the γ-CuI one (F-43m, a = 6.054 Å) that is very promising as p-type transparent material. In this work, thin films of CuI have been synthesized by the iodination of sputtered Cu coatings with iodine vapor to investigate the film properties and their optoelectronic performance. The structural, electrical, and optical properties of CuI thin films deposited on glass and silicon substrates were studied by X-ray diffraction, Hall effect, UV-visible spectrometry and photoluminescence. We obtained transparent p-type semiconductors films crystallizing in the γ-phase with wide bandgap ($E_g \approx 3.1$ eV). Copper iodide films exhibit a strong preferred orientation in the [111] direction. Thin film morphology, examined by scanning electron microscopy, shows a variation of crystal size depending on the iodination conditions. Crystallographic twin domains in CuI grains have been observed by transmission electron microscopy (TEM) and selected area electron diffraction (SAED) through which the twin geometry and orientation can be understood, This information is crucial for further improvements of perovskite solar cells.