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Characterisation of Cu_2O/CuO thin films produced by plasma-assisted DC sputtering for solar cell application

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Abstract

For large-scale implementation of devices magnetron sputtering is a practical method of producing metal oxides, however sputtered copper oxides tend to form as a mixture of Cu_2O, Cu_4O_3, and CuO, with Cu_2O being particularly difficult to produce reliably in pure form. In this study, nanostructured thin films of Cu_2O, Cu_4O_3, and CuO were prepared using a novel reactive sputtering system, based on plasma-assisted DC magnetron sputtering with deposition and plasma assisted reaction zones spatially separated enabling separate control of film oxidation. X-ray diffraction, optical spectroscopy, and Raman Spectroscopy were used to characterise the physical and optical properties and it is shown that plasma-assisted DC sputtering is a suitable technique for reliable production of CuO and Cu_2O films in large areas at room temperature without the necessity of further processing. The results also indicate that solar cell performance may relate positively to the presence of crystalline Cu_4O_3 (200) and/or Cu_2O (111) over other crystalline forms of copper oxide or amorphous copper oxide thin films.