The effects of thickness on optoelectronic properties of Mg-doped $CuCrO_2$ thin films

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Abstract

In this work, *p*-type $CuCrO_2$ thin films are deposited on soda-lime glass substrates from a 3-inch ceramic target doped 2.5 at. % Mg by dc magnetron sputtering. The substrate temperature is set at 450 ^oC and the sputtering current is fixed at 350 mA for all films while the sputtering time is changed to investigate the thickness of the films. XRD results prove the existence of $CuCrO_2$ structure via diffraction peak at *ca*. $2\theta = 36.4^o$ belonged to (012) plane regardless film thickness. However, (110) plane peaked at *ca*. $2\theta = 62.5^o$ is only formed as film thickness reached 500 nm. Interestingly, (110) plane has the highest intensity at film thickness of 700 nm and the resistivity obtains the lowest value at this one which indicates that the resistivity of the film has a strong dependence with the crystal orientation. The lowest resistivity is 4×10^{-2} Ω.cm for the film whose thickness is 700 nm. Besides, the increase of thickness gives rise to a dramatic decrease of the optical transmittance of the films because of the strong optical absorption.

Keywords: *Mg-doped $CuCrO_2$; delafossite; film thickness; p-type.*