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Deposition of complex materials using powder targetsFrancis Boydens¹, Stijn Mahieu¹, Diederik Depla¹¹Ghent University, Gent, Belgium

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The deposition of complex oxides by reactive magnetron sputtering can be achieved by several strategies. The choice for a given strategy is a balance between control and flexibility. On the one hand, control of the film composition can be achieved with a one source approach as the stoichiometry of the deposited oxide is controlled at target level. Flexibility on the other hand can be achieved by a multi-target approach.

In this paper both of these approaches are combined by means of pressed powder targets in order to obtain a high flexibility as well as superior compositional control. Maximum flexibility is assured as the composition of the powder mixture can be easily changed. One can of course question the compositional control at the thin film level. Hence, fundamental research is performed in order to understand the relationship between target and film composition.

Powders of Cu and Al with a maximum grain size of 50 μm are mixed in different ratios. The mixtures are mechanically pressed into a two inch target. The latter is mounted in a conventional magnetron and, as a first step, used to deposit Cu/Al thin films. The surface composition of the target before and after sputter deposition is measured together with the thin film composition by EDX (Energy Dispersive X-ray analysis). The relationship between both is investigated.

The same targets are also used to deposit Cu-Al-O thin films with different compositions. The influence of the target composition on the reactive behaviour is investigated. Using the same approach as discussed in the previous paragraph the relationship between target and thin film composition is investigated. The optical and electrical properties of the deposited Cu-Al-O thin films are studied by respectively UV-VIS-NIR measurements and four probe measurements. Also the morphological (FEG-SEM) and crystallographic (XRD) properties will be presented.

This detailed research shows that this simple approach is a suitable and valuable technique for fast scanning of the compositional influence on material properties.

Keywords

magnetron sputtering

powder target

Cu-Al-O