DOI: 10.1017/S1431927608088053
Microsc Microanal 14(Suppl 2), 2008

XAS and grazing angle XRD of the CoTi2 thin films grown by DC co-sputtering technique

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The cobalt-titanium thin films were prepared to 500°C in an INTERCOVAMEX V3 sputtering system equipped with four magnetrons assisted by DC pulsed and direct DC. A polished highly oriented (400) silicon wafer was used as substrate. Some references can be read for more information [1,2]

Thin films were grown by co-sputtering by using a DC source, with nominal powers of 50 watts, 80 watts and 110 watts. The co-sputtering technique consists of covering the target surface with similar parts of another material.

Fig. 1 displays the XRD spectra that corresponding to the films coti/si1, coti/si2 and coti/si3 grown at 7% of Co concentration, with powers of 110 watts, 80 Watts and 50 Watts, respectively. With database the present phases were identified, with $CoTi_2$ (Fd3m, fcc) in greater measurement of the Cu_2Mg type, Ti (hex) with P63/mmc (194). Fig. 2 shows the XRD spectra for the thin-films CoTi/Si4, CoTi/Si5 and CoTi/Si6 grown at 11% of cobalt concentration. It is possible to be appreciated that the present phases are the same ones that the previous case, reason why the phases stay for the two cobalt concentrations. Fig. 3 presents the XAS spectra around the Co K-edge ionization for the thin-films grown with Co and Ti, Them were collected in the fluorescence mode. The spectra have been numerically processed by WINXAS software from the background subtraction until the normalization. The pre-edge background was removed by the standard method of using a power-law function to curve-fit the pre-edge region and subtracting this function beyond the edge. Analyzing the absorption spectra of cobalt in the $CoTi_2$ phase we can appreciate that they agree in energy with the reference spectra that corresponds to the CoO, which indicates that the valence whereupon working is Co^{2+}. Fig. 4 displays the radial distribution function (RDF) for the six samples. It may be obtained by applying a fast Fourier Transformation of EXAFS signal,

The RDF experimental results are compared with those RDF´s generated theoretically by using FEFF software, from a model compound of CoTi2 phase obtained by XRD. The fitting procedure is a highly iterative process. Fits are also checked in R-space using both the real and imaginary parts of Fourier transform. The later is an important check for the presence of overlapping coordination shells and the correctness of the assumption about the nature of the coordinating atom. The fitting process for this case is presented in table1.

References

[1] L. Smardz, K. Smardz, R. Czajka. Cryst. Res. Technol. 36 (2001) 8-10, 1019
[2] Lijuan Zhang, M. L. Jenkins, G. Taylor. Jour. Cryst. Growth. 289 (2006) 308

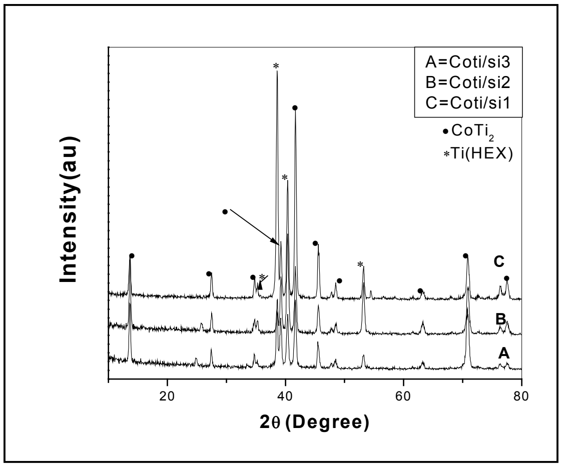

FIG. 1

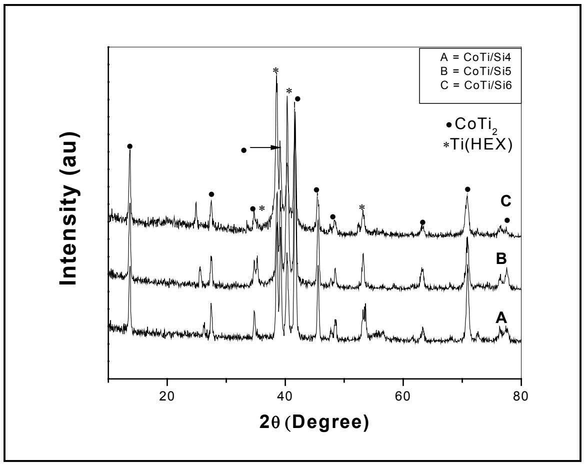

FIG. 2

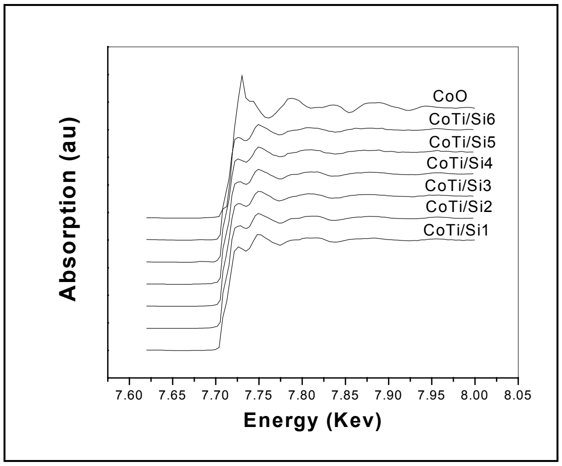

FIG. 3

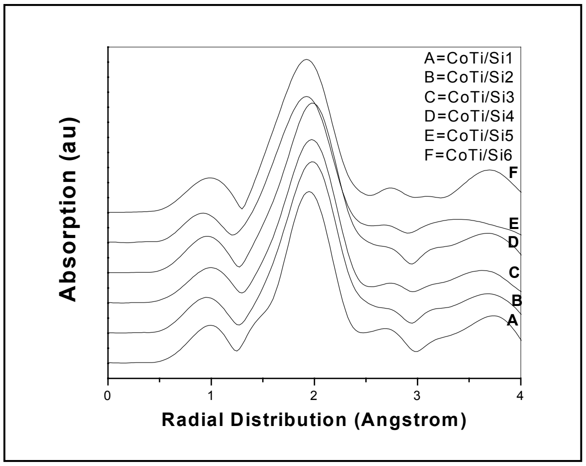

FIG. 4

Sample	$R_{Experimental}$ (Å)	$R_{Teoretical}$ (Å)	Distance	E_R ($\Delta R/R$)
CoTi/Si1	2.089053	2.06027	Co-Ti	0.0139704
	2.153700	2.06027	Co-Co	0.0453484
	2.417584	2.37900	Co-Ti	0.0162185
CoTi/Si2	2.115567	2.06027	Co-Ti	0.0268396
	2.190900	2.06027	Co-Co	0.0634043
	2.442585	2.37900	Co-Ti	0.0267276
CoTi/Si3	2.131695	2.06027	Co-Ti	0.0346677
	2.214382	2.06027	Co-Co	0.0748018
	2.445331	2.37900	Co-Ti	0.0278818
CoTi/Si4	2.115314	2.06037	Co-Ti	0.0267168
	2.189113	2.06037	Co-Co	0.0625369
	2.444246	2.37900	Co-Ti	0.0274258
CoTi/Si5	2.141896	2.06037	Co-Ti	0.0396190
	2.230385	2.06037	Co-Co	0.0825692

TABLE 1.