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Oxidation of CoTi: a study by XPS

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Abstract. The oxidation of CoTi has been studied by XPS. Oxygen exposure in the range up to 10^4 L generates a mixed Ti oxide system with TiO and Ti_2O_3 as major components. There is no evidence for TiO_2 or for oxidation of Co.

CoTi is an ordered binary alloy adopting the CsCl structure. It has potential as a cheap hydrogen storage material. However, passivating oxide overlayers may inhibit hydrogen uptake. We report here results of a study of oxidation of CoTi by XPS.

The surface stoichiometry of CoTi(110) is sensitive to sample pre-treatment. Ion bombardment alone produces a Co-enriched surface whilst high-temperature annealing generates a Ti-enriched surface. Oxygen diffusion from the bulk is seen during annealing.

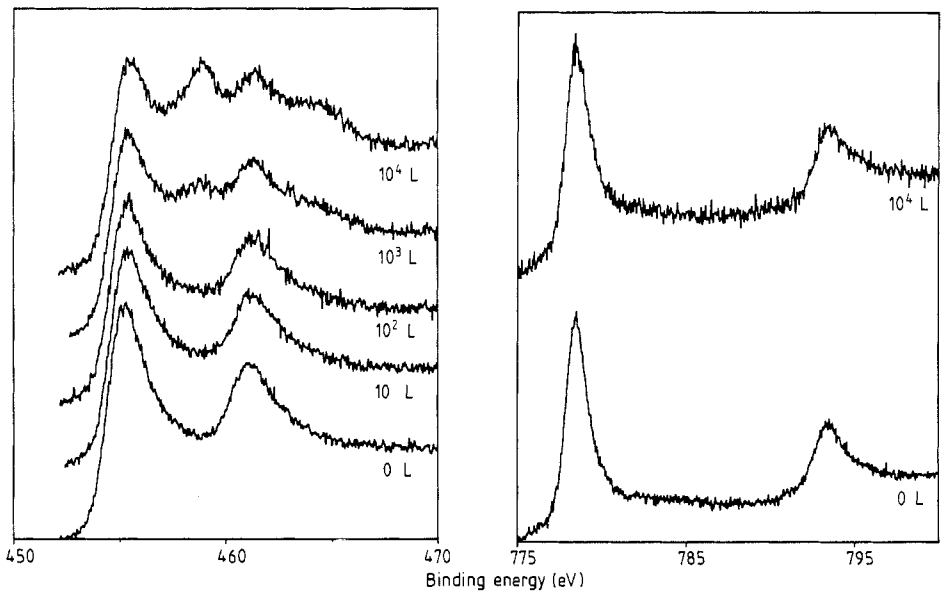

Figure 1. Ti:2p (left-hand panel) and Co:2p (right-hand panel) Al Kα XPS of CoTi recorded at 15° emission angle as a function of oxygen exposure. In the Ti:2p region, note the increase in intensity at +3.5 eV binding energy relative to the metallic Ti peaks with oxidation.

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Exposure of CoTi to oxygen at 300 K produces chemically shifted Ti 2p peaks at +1.8 and +3.6 eV BE relative to the alloy peak in XPS. By curve fitting and by comparison with the literature [1] these can be related to TiO and Ti_2O_3 respectively. At no time was a shifted peak due to TiO_2 seen. The cleanest CoTi surface shows some Ti^{2+} component and as oxidation proceeds the Ti^{3+} becomes visible until, after 10^4 L exposure, it is comparable in intensity to the alloy Ti peak in grazing-emission spectra. The Co 2p peak remained unaltered throughout (figure 1).

The oxidation of Ti in CoTi appears similar to that of Ti metal [1] but alloying inhibits oxidation of the Co component [2].

References

[1] Armstrong N R and Quinn R K 1977 *Surf. Sci.* **67** 451–68
[2] Brundle C R, Chuang T J and Rice D W 1976 *Surf. Sci.* **60** 286–300