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A study of thermal response of chromium-tin (Cr-Sn) bimetal films using in-situ RBS by Artificial Neural Networks

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Bimetallic thin films of chromium-tin (Cr-Sn) were prepared using electron beam evaporator, the films were prepared such that a layer of chromium was deposited onto a thin film of tin. The first sample was then annealed in the Rutherford Backscattering Spectrometry (RBS) chamber under high vacuum, while probing with alpha particles. The RBS spectra were collected in-situ while annealing at a ramp rate of 3℃/min, from room temperature to 600℃. A 2 MeV He^{2+} ion beam was used to probe the sample for atomic depth profiling evolution. The collected spectra were analysed using Artificial Neural Networks (ANNs). The ANN model was trained using a set of simulated RBS spectra generated using the SIMNRA software package. The results of stochiometric analysis showed that the layers of Cr-Sn start phase changing at temperatures of ˜275℃ and ˜475℃ for the CrSn and Cr_2Sn phases respectively.
The second sample was heated using femtosecond laser with the wavelength of 1064 nm, and a pulse duration of 190 fs, with the repetition rate of 200 kHz, the net-fluence used were ranging from 300 J/cm^2 to 970 J/cm^2. The two-temperature model was performed using the finite element method to study the thermal behaviour of the films, the results revealed that the films absorbed the laser heat within a few picoseconds. The results of this study demonstrate the potential of ANNs in the analysis of RBS spectra and the importance of considering the thermal effects during thermal treatment.

Apply to be considered for a student ; award (Yes / No)?

yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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