Comparison of thermal and Laser heating activation energy calculation of Sn-Zn

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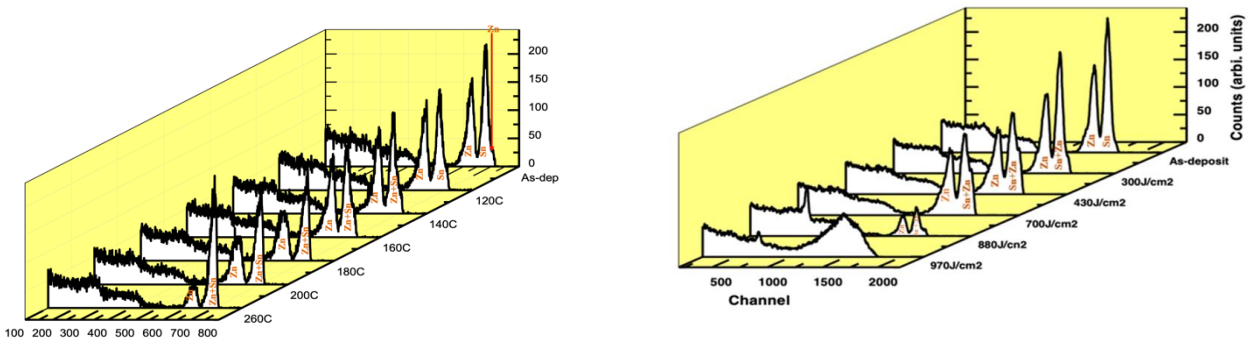
Thin bimetallic films of tin and zinc were annealed using copper resistive heater and also by femtosecond laser. For the resistive heating scenario, the sample was probed with 3 MeV energetic alpha particles from the tandetron accelerator in order to follow the locus of the atomic diffusion and the atomic depth profile of the system. The same was done for the femtosecond laser heating, the onset laser fluence was tuned such that it was below ablation threshold, and this increased in small increments in order to promote the tin and zincs atomic mixing.

The Rutherford backscattering spectrometry data was used to determine the mixing of the tin and zinc atoms from the plot of the reactions as shown in Fig. 1 for both heating regimes, and from that, the reaction activation energy was calculated which was around 44.6kJol/mol, which is a reported figure in literature using other experimental techniques [1]. This study showed the reliability of using laser heating for determining activation energy of bimetallic systems.



(a) **Resistive heater** **(b) Laser heating**

Figure 1 (a-b): Rutherford backscattering spectrometry plots of resistive copper heating and femtosecond laser heating.

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References: [1] Shrestha, T., Gollapudi, S., Charit, I. and Murty, K.L., 2014. Creep deformation behavior of Sn–Zn solder alloys. Journal of Materials Science, 49(5), pp.2127-2135.