Contribution ID: **314** Type: **Oral Presentation**

Electrical and structural properties in Mo-Re alloys; a study on their superconductivity.

Tuesday 8 July 2025 12:10 (20 minutes)

Previous studies [1,2] reported on superconductivity (SC) observed for alloy systems with the general formula $Mo_{1-x}Re_x$. In order to probe this behaviour further, three samples $Mo_{73.5}Re_{26.5}$, $Mo_{67.1}Re_{32.9}$, and $Mo_{79.5}Re_{20.5}$ were prepared and characterized. Pure elements, 99.99 % in purity, of Mo and Re were used to synthesize the three samples utilizing the arc-melting technique. Analysis of x-ray diffraction results show that these alloys exhibit both body-centred cubic (BCC) and the A15 phases. The A15 phase, with a β-W crystal structure, is typically observed in intermetallic compounds of the form Y_3Z, where Y is a transition metal, and Z is any element and is associated with superconducting behaviour [3]. The four-probe method was used for resistivity as a function of temperature, $\rho(T)$, measurements. All the samples showed normal metallic behaviour on cooling down from 300 K to the temperature associated with the onset of SC, T_{sc}, where a clear anomaly in the form of a step in the $\rho(T)$ curve is observed. As the applied magnetic fields are increased, the T_{sc} values shift to lower temperatures. Alternating current heat capacity measurements as a function of temperature, $C_p(T)$, were performed. Clear transitions, in the form of humps, are observed in the $C_p(T)$ curves of the $Mo_{67.1}Re_{32.9}$ and $Mo_{79.5}Re_{20.5}$ samples, corresponding to T_{sc} values of (9.53 ± 0.02) K and (9.98 ± 0.05) K, respectively.

References
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Session Classification: Physics of Condensed Matter and Materials 2

Track Classification: Track A - Physics of Condensed Matter and Materials