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MICROSTRUCTURAL CHARACTERIZATION OF HIGH TIN BRONZE MIRROR, ARNAMULA, KERALA

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ABSTRACT

Mirrors had both aesthetic value and magico-religious significance in parts of Asia, as in China and India. High tin Bronze mirror were used in various parts of the ancient world and it was observed that first bronze mirror was manufactured in China. The Chinese bronze mirrors were having the lead percentage and this lead was added to improve the castability, however, addition of lead might have compromised the reflectivity. Initially it was understood that the process of making bronze mirror have been transformed from China to other part of the world including India. In this investigation, chemical composition analysis and microstructural examination was carried out for three different samples collected from the different mirror workshop located in the Aranmula, Kerala. It is important to mention that craftsmen of Aranmula are still making the mirror by traditional method. Elemental composition analysis was conducted using the micro-XRF and results indicate the presence of copper and tin and no lead was detected, however significant percentage of lead was reported in the Chinese mirror. XRD analysis showed the presence of the delta phase (Cu41Sn11). Microstructure consist of delta and eutectoid (alpha+eutectoid) phase. The presence of dendritic structure revealed that mirrors were manufactured by the casting route and no heat treatment was given. Delta phase being a stable compound did not corrode or tarnish easily. High tin bronzes are very brittle in nature and this brittleness in the Aranmula was not offset by adding the lead but by casting a thin mirror in comparison to the rest of the world. Thus, it may be understood from the compositional and microstructural analysis that process of mirror making in Aranmula was not transferred by the China however, Aranmula people are using the locally developed process.

Keywords: High tin bronze; Mirror; Delta phase; Eutectoid; Aranmula