This paper presents microstructural evolution in the binary aluminium manganese Heuslar alloy near equiatomic composition which exhibits attractive magnetic properties. The Heusler phase Mn$_{55}$Al$_{45}$ known as τ-phase is not an equilibrium phase in Al-Mn binary system and has a metastable existence. We have successfully synthesize this phase through various processing routes. There exists a debate in the literature about the mechanism of growth of this phase during the formation from the high temperature equilibrium ε-phase. By employing various microscopic techniques including structural characterization through transmission electron microscopy, analytical characterization through microprobe, orientation imaging and in situ transmission electron microscopy. The parameters in the melting process as well as the effect of cooling rate on their microstructure, phase evaluation changes of this metastable ferromagnetic τ-phase ingot have been studied. We are successful in unravelling the pathways for the formation of ferromagnetic tetragonal τ-phase and their decomposition to equilibrium phases. We show that τ-phase forms from high temperature hexagonal ε-phase with little change in composition and containing significant amount of planar defects. It decomposes through an eutectoidal transformation through the formation of cubic-β and rhombohedral-γ2 phase. Along with these results, we shall also present the magnetic properties which can be mapped with the changes in the microstructure.

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