

Effect of pressure on the formation of the Al–Cu–Fe quasicrystalline phase

Kamaeva L V^{1,®}, Suslov A A¹ and Brazhkin V V²

¹ Udmurt Federal Research Center of the Ural Branch of the Russian Academy of Sciences, Tatiana Baramzina Street 34, Izhevsk, Udmurt Republic 426067, Russia

² Vereshchagin Institute for High Pressure Physics of the Russian Academy of Sciences, Kaluzhskoe Shosse 14, Troitsk, Moscow 108840, Russia

® lara_kam@mail.ru

In the present work, a comparative analysis of the formation of the $i\text{-Al}_{62}\text{Cu}_{25.5}\text{Fe}_{12.5}$ icosahedral phase from the melt under low cooling rates at normal and 5.2 GPa pressures has been carried out. Crystallization of the $\text{Al}_{62}\text{Cu}_{25.5}\text{Fe}_{12.5}$ alloy cooled from 1673 K at 0.1 K/s begins with the formation of the Al_3Fe phase. The icosahedral phase is formed by the reaction $i \rightarrow L + \text{Al}_7\text{Cu}_2\text{Fe}$ after the formation of the $\text{Al}_7\text{Cu}_2\text{Fe}$ -phase (ω -phase) by the reaction $\omega \rightarrow L + \text{Al}_3\text{Fe}$. When the melt solidifies under high pressure conditions, the i -phase is also formed by the peritectic reaction, however, the general kind of crystallization changes; at the first stage, the AlFe and Cu_3Al phases are formed from the melt and remain up to room temperature. Thus, changes in the kind of crystallization with increasing pressure lead to a change in the phase composition of the alloy after crystallization and an increase in the fraction of i -phase.

The study was supported by the Russian Science Foundation (grant No. 22-22-00912, <https://rscf.ru/project/22-22-00912/>).