Liquid-liquid Interfacial Tension in Ternary Monotectic Alloys Al-Bi-Cu and Al-Bi-Si

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There exists a high scientific and industrial interest to the multicomponent metallic alloys showing a miscibility gap in the liquid state. For example, Al-based monotectic alloys are considered as potential candidates for advanced bearings in car engines. Therefore a number of experimental investigations have been carried out in order to become proficient in casting of these alloys. However surprisingly it is, there exist virtually no experimental data on the physical property playing a crucial role in the demixing and solidification processes - liquid-liquid interfacial tension.

In this work we present the interfacial tension in ternary Al-based monotectic alloys determined from the force acting on the alumina stamp detached to the liquid-liquid interface, which is measured experimentally. The relation between the force exerted by the meniscus on the stamp and the shape of the meniscus, which is modeled by the numerical solution of the Laplace equation of capillarity, underlies the basis of the method applied.
The liquid-liquid interfacial tension in the ternary Al-Bi-Cu and Al-Bi-Si alloys has been determined in dependence on the temperature over a wide temperature interval and on the Cu (Si) content over a wide concentration range. The experimental values of the interfacial tension obtained in this study are compared with the respective data for the binary Al-Bi monotectic system. The temperature and composition dependences of the interfacial tension are also analyzed with the respect to available ternary phase diagrams.