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Mechanical and microstructure properties of the metallic composites based on gallium and containing InBi intermetallic compound

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Abstract

Metallic composites based on gallium are diffusive-hardening alloys. They can be prepared by mechanical mixing of liquid gallium alloy and solid powder-filler which can be of different chemical and fraction composition and of different particles shape. The paste synthesized solidifies during certain time interval and forms metallic composite material that demonstrate comparatively high compression strength (up to 500 MPa and more). At the same time, the composite contains the softening phases. This leads to the following situation: material that works good under compression demonstrate low characteristics after stretching and bending. Its strength under such a mechanical influences is an order of magnitude lower. So, it is necessary to reduce the amount of softening phases (like solid solution of gallium in tin). It can be reached by particular or full substitution of the phases mentioned above by intermetallic compounds. Here, results of such substitution were studied. One of the most important fact established is the following: when using bismuth powder as the addition to filler, we can prepare the material with essential amount of InBi intermetallide in its structure. Further we studied the microstructure of such composite alloys and also their behavior under compression. It was shown that new material obtained is essentially more plastic and it is less prone to brittle failure than "ordinary" ternary Cu-Ga-Sn alloys. The metallic composites synthesized in this work are perspective materials for using as diffusive-hardening solders with high exploitation characteristics.

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