Thematic Section: Physicochemical Research. **Full Paper**
Subsection: Metallurgy.
Reference Object Identifier – ROI: jbc-01/17-50-4-141
The Digital Object Identifier – DOI: 10.37952/ROI-jbc-01/17-50-4-141
Submitted on April 24, 2017.

Physico-chemical properties of metallic composite materials based on gallium

© **Aleksey B. Shubin**,*+ and **Leonid F. Yamshchikov**
Laboratory for Physical Chemistry of Metallurgical Melts. Institute of Metallurgy of Ural Branch of Russian Academy of Sciences. Amundsen St., 101. Ekaterinburg, 620016. Russia. Phone: +7 (343) 232-91-38. E-mail: abshubin@gmail.com

*Supervising author; +Corresponding author

Keywords: gallium, alloy, diffusive-hardening material, metallic composite.

Abstract

Diffusive-hardening alloys based on gallium and containing additional metallic components (powder fillers) can be used as metallic composite materials and lead-free solders which can be easily prepared, are hardening at room temperature and demonstrate high strength after hardening. The achievement of high mechanical characteristics of DHA is important and not fully solved problem. One of the important problems is the affording of high mechanical characteristics of such alloys. At the same time the materials mentioned above must show predefined structure and physic-chemical properties. Here, the rheological properties of powder mixes and gallium pastes have been studied. Also the influence of the fractional composition onto the material properties was investigated. The linear coefficients of thermal expansion were also studied for a number of compositions.

The structure of alloys was studied by SEM (*Carl Zeiss EVO 40*) and EDX method (*Oxford Instruments INCA X-Act spectrometer*) and also by X-Ray diffraction (*Shimadzu XRD 7000C diffractometer*). Increase of dust-like fraction in the powders of 34-40 μm in size leads to the decreasing of initial hardening time fron 5 to 2 minutes. The conclusion is the following – the fraction of dust-like powders in filler mixes must not be higher than 13-15 wt.%. Only if this condition is completed the gallium paste hardening began after at least 4 min.

Physico-chemical and mechanical properties of gallium pastes consisting of the Cu_3Sn filler, gallium and tin meet to considerably high requirements for modern fusible solders.

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