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STUDYING OF INTERFACES IN MULTICOMPONENT MATERIALS WITH THE USING OF ANALYTICAL ELECTRON MICROSCOPY

The method of analytical electronic microscopy was used for the study of interfaces between heterogeneous elements. High locality of quantitative X-ray microanalyse is achieved by the test of thin foils (thickness about 100 nm) and fine electron beam (0.5–15 nm). The transitional area thickness in the layered composite of Cu–Nb was estimated at 2.5 μm by standard X-ray microanalysis of bulk sample. Being carried out on analytical complex JEM-2100F of thin foils, the analysis shows that for a small step between the analyzed points (5–10 nm), the transitional area is ~ 3–5 nm. HR TEM and method of FFT of Cu–Nb interface show that the process of mutual penetration of elements takes place within of a few interplanar spacings. In powder composites of 80Ni–20Mo and 50Fe–50Cr, abnormal high diffusion was detected. Both pairs are characterized by unidirectional diffusion, and more, refractory component has considerably higher diffusive mobility than low-melt one. The results indicate that the interface between contacting elements plays a substantial role in the mechanism of alloy formation under the effect of high deformations. The results presented in paper show that precise studying of interfaces with the use of analytical electron microscopy allows not only increase in locality of the quantitative analysis of distribution of elements in near-interface areas but also considerable advance in understanding of mechanisms of contact formation and diffusion in heterocomponent composites.

Keywords: analytical electron microscopy, area of contact, Cu–Nb, Ni–Mo, Fe–Cr

Fig. 1. Structure of interphase copper-niobium boundary

Fig. 2. Distributing of elements near–boundary area [5]

Fig. 3. Interphase copper–niobium boundary: *а* – structure of boundary, *б* – distribution of elements (–□–) and (–○–)

Fig. 4. Structure of area of copper–niobium contact: *а* – high resolution of boundary; *б* – FFT development

Fig. 5. Fracture of sample with a crack in plane of copper–niobium contact

Fig. 6. Structure of interphase boundary of Ni–Mo (I) and Fe–Cr (II): *а* – microstructure; *б* – distribution of elements near-boundary area: –□– – Ni, –○– – Mo, –△– – Cr, –◇– – Fe