

Wetting Transition Phenomenon in Rapidly Solidified Al-In Alloys

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Recently, wetting behavior of aluminum alloys has drawn considerable attention because hydrophilic and hydrophobic metal surfaces exhibit promising applications in energetics, electronics and radio engineering. Since chemical composition and topography play a key role in the control of surface wettability, surface sensitive methods for elemental depth profiling analysis are required to understand the influence of different alloying elements on wetting state of aluminum materials in order to develop multicomponent alloys with tailored properties.

Our recent studies have demonstrated for the first time a possibility of production of rapidly solidified (RS) aluminum alloys with controlled wettability to protect materials from the harmful effects of water. This work presents a continuation of the research carried out on RS Al-In alloys [1] and is aimed to reveal how surface chemistry affects wetting properties of alloys. The Rutherford backscattering spectroscopy (RBS) was used for elemental depth profile analysis of RS Al-In alloys containing from 0.02 up to 5.5 at % In to study the chemical composition in the outermost layers of the surface. Measurements were performed using a 1.7 MeV He⁺ ion beam for drum-side (A) and air-side (B) surfaces of the foils. The RBS spectra were fitted by simulation with RUMP code.

It was found that In concentration at the thin surface layer (0.02 μm) of RS foils exceeds manyfold its concentration in the bulk. Revealed degree of In enrichment in the near-surface region is maximal at low concentrations of In in alloys. In addition, the concentration effect of alloying element on the surface contact angle (CA) of distilled water was also investigated. Figure 1 demonstrates that CA is decreased while the In content increases at the foil surface. Pronounced wetting transition from the homogeneous Wenzel state to the heterogeneous Cassie-Baxter state is discussed in terms of the penetration of water into the micro/nanostructures of foil surfaces.

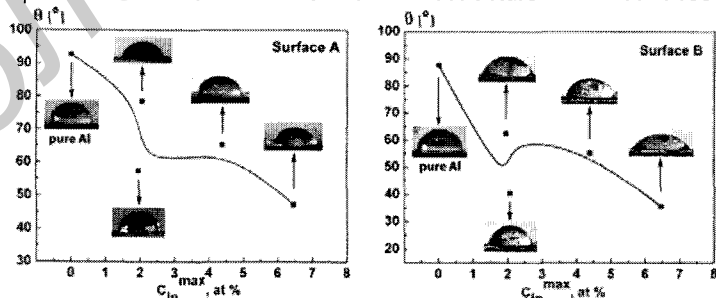


Fig. 1. Effect of In content at the foil surfaces of RS Al-In alloys on the CAs.

References

- [1] Tashlykova-Bushkevich I.I., Yakovenko J.S., Bushkevich I.A., Zukowski P.: *Effect of topography on wettability of rapidly solidified Al-In alloys*, Przegląd Elektrotechniczny, 92 (1), 2016, p.151-154.