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ENERGY

# Effect of Topography on Wettability of Rapidly Solidified Al-In Alloys

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Surface microstructure and its wetting characteristics have been the subject of extensive study of metals in a wide range of industrial applications (spray quenching, soldering etc.) and microelectronics. In particular, a lot of attention has been paid to wettability behaviour of aluminium-based alloys due to its high thermal and electrical conductivity, low specific weight as well as low contact resistance and beneficial effects of small amounts of a number of metals on electrochemical properties. Therefore, both from the scientific point of view and the technical side an in-depth understanding of mechanisms which affect the wettability of solid surfaces is of great importance to tailor such properties of engineering and electronic aluminium materials as adhesion, anticorrosion, catalysis, to name a few.

In the case of aluminium, there are a number of experimental approaches which can be classified as roughening methods to modify the surface morphology and vary wetting properties. While pioneering works [1] demonstrated promises in wettability tuning of shallow surface regions of Al-doped materials by means of pulsed laser treatment, our recent studies revealed that the surface roughness can be also controlled by alloying elements in rapidly solidified (RS) aluminium alloys [2]. The chemical composition and microstructure at the surface differ from the bulk of RS foils due to a solute segregation phenomenon in Al alloys solidified at extremely high cooling rates. This fact suggests that chemical heterogeneities of RS foil surface, its roughness and local defects may have a strong influence on wetting properties, emphasizing the need for exploratory research of wettability behaviour of RS Al alloys which is still not addressed to date.

In this work, we investigate effect of surface topography on the wettability of RS Al-In alloys containing up to 4.7 at% of In by means of atomic force microscopy and water contact angle measurements. Indium is reported to be considered as an alloying element in Al-based alloys for interconnect applications and is one of the promising additives in leed-free Zn-Al based solders that lower the melting temperature because electronic devices and substrates cannot endure high reflow temperatures.

For the first time, it was found that indium significantly changes wetting properties of high purity Al foils which exhibit hydrophobic behaviour. The Al-In alloys demonstrated hydrophilic properties. An increase of In concentration resulted in a transition from a homogeneous to a heterogeneous wetting regime when decreasing the roughness of the surface makes it more hydrophilic. Obtained original results expand the current knowledge of mechanisms affecting wettability of rough surfaces of Al alloys.



## References

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