

ICAM 2009

11th International Conference on Advanced Materials

Symposium V Structures and Properties of Metastable Materials

ABSTRACT

Metastable Systems for Wettable Cathodes in the Aluminum Industry

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Large amounts of energy saving could be achieved in the primary aluminum industry by using cathodes which can be wetted by liquid aluminum instead of the graphitic cathode blocks presently used. The utilization of wettable cathodes would allow a reduction of the thickness of the liquid aluminum metal pad in the electrolysis cell and a decrease of the anode-cathode distance. As a result, a decrease of the voltage drop through the cell is expected. For this reason, researchers have investigated for several years the wetting behaviour of various electrically conducting ceramics such as TiB_2 . The good wetting property and chemical inertness of TiB_2 in liquid aluminum also lead to its use as grain refiner in the casting of aluminum alloys. In this case, recent reports^{1,2} have suggested that it is not the surface of TiB_2 which wets and nucleates α -Al but a thin layer of Al_3Ti which forms on the surface of the ceramic at the TiB_2 /melt interface. According to these authors, the aluminide which normally should be unstable in liquid aluminum, would be stabilized by the presence of the TiB_2 surface. Based on these findings, novel composites made of refractory hard metal ceramics and their aluminides were developed. Preliminary results on the wetting behaviour of liquid aluminum on such systems will be presented.

¹ P. Schumacher and A.L. Greer, Materials Science and Engineering, A181/A182 (1994) 1335

² P.S. Mohanty and J.E. Gruzleski, Acta Metall. Mater., 43 (1995) 2001