INVITED PRESENTATION

Chemically and Electrically Assisted Impurities Control in Liquid Melt

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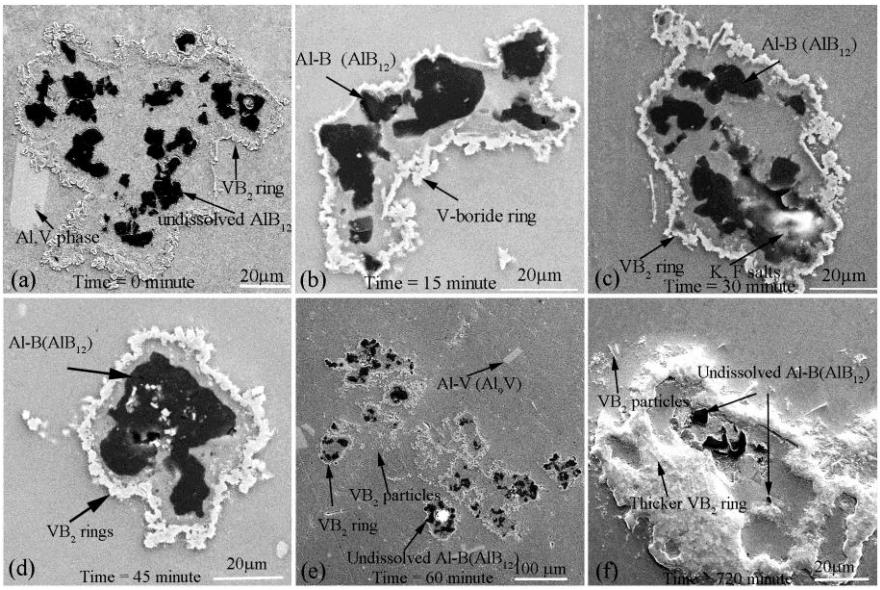
Impurities control is vital in liquid metal processing to ensure that the metal products meet the compositional requirement. This presentation will discuss recent works from our group in the control and removal of impurities during liquid metal processing. In the first example, control and transition metals (V, Zr) removal from Al melt was carried out by the addition of AlB_2/AlB_{12} alloys to tie these impurities. These solute V and Zr are harmful on the electrical conductivity of Al. Complex (V, Zr) borides ring were formed around the B alloys. The results indicate that different B alloys provide different microstructure of the (V, Zr)B_2 that form. The effective removal of the impurities is also affected by the breakage of the borides ring. Therefore industrial practice needs to consider the type of B alloys, the procedure (when, where) of the addition, and the stirring practice to assist the breakage of the boride ring. The second example is the removal of boron impurities in liquid Si for the production of solar grade Si. In our work, the B removal was carried out by slag reaction and assisted by applying electrical potential difference across the slag-silicon melt. The CaO-SiO_2-Al_2O_3 based slag was used in the study. The application of up to 5 V difference resulted in the increase of the mass transfer kinetics of B (80% faster) and shifting the equilibrium that allow more B to be absorbed by the slag (B partitioning to the slag was increased by 70%).



Microstructure evolution of the boride ring during B treatment for removing solute transition metals (V and Zr) from Al melt