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Fading of the grain refinement effects in Al-Cu alloys

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Grain refinement of aluminium alloys is common industrial practice. Many researchers have extensively investigated this field over the past 50 years, not only to develop efficient grain refiners for different aluminium alloys, but also to achieve an understanding of the mechanism of grain refinement. The present research was been conducted on thin-walled castings with 5mm wall thicknesses. In this work an influence of three different master alloys was investigated, namely: (1) Al-5% Ti-1%B, (2) Al-5%Ti and (3) Al-3%B, respectively on the structure and the degree of under-cooling ($\Delta T_{\alpha} = T_{\alpha} - T_{min}$, where T_{α} - the equilibrium solidification temperature, T_{min} - the minimum temperature at the beginning of α (Al) solidification) of an Al-Cu alloy. The roles of the fading have been investigated at different time spent on refinement treatment i.e., from, 3, 20, 45 and 90 minutes, respectively from adding master alloys. Thermal analysis was performed to determine the real cooling rate and solidification parameters, e.g., degree of under-cooling, recalescence, etc, whereas metallographic examination was conducted for macro and micro-structure characteristic. It can be concluded that the fading effects of refinement of the primary structure is accompanied by a significant change of number (dimension) of primary grains, which can be correlated with solidification parameters, determined based on thermal analysis. Finally, it is shown that the refining process of primary structure is unstable and requires strict metallurgical control.

Biography

Gabriela Sikora has completed her full-time studies from AGH University of Science and Technology in Krakow, Poland. She obtained a Master's degree on the Faculty of Foundry Engineering. Currently, she is the PhD student at the AGH University of Science and Technology where she deals with the solidification and structure formation of aluminum-copper alloys.

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