EFFECTS OF SODIUM ADDITION AND RAPID COOLING ON MICROSTRUCTURE OF AL-SI ALLOY FOR SMALL HYDRO

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Abstract

Al-Si alloy has been practically used as the material for buckets of small hydro due to its excellent strength and castability. Recently, the environment where the small hydro operates has been found to be more severe. This has necessitated the use of higher Si concentration in Al-Si alloy. However, in case of high Si concentration in the alloy deterioration of the buckets continued due to presence of heterogeneous primary Si precipitates which are formed during casting. Reduction of primary Si precipitation by eutectic modification (sodium fluoride addition) or homogeneous primary precipitation by rapid cooling is necessary to solve the problem. Although the former technique has been successfully used, it is thought to be impossible to create the heterogeneous primary Si precipitation free Al-Si alloy in case of an alloy with over 13.5 wt% Si according to the phase diagram. The latter technique is thought to be effective in this case. In this study, the effect of eutectic modification on reduction of heterogeneous primary Si precipitation and the effect of rapid cooling on homogeneous primary Si precipitation while casting using high Si concentration Al-Si alloy (12 to 15 wt% Si) on various condition of cooling speed with and without sodium fluoride addition was investigated. Chamotte and mild steel moulds were used to cast the ingots. Consequently, heterogeneous primary Si precipitation occurred even on the condition of the chamotte mould and eutectic modification conducted on the molten alloy in any cases of over 13.5 wt% Si. On the other hand, submicron primary Si particles dispersed homogeneously on the condition of the mild steel mould not only with eutectic modification but also without the modification in these cases. In addition to the above results the cases of bucket fabrications by sand casting and investment casting will be presented.

Key words: Bucket, heterogeneous, modification, phase diagram, mould