Muhammad NABEEL

KTH Royal Institute of Technology,
Stockholm
Sweden

It is well known that clusters which are formed in liquid steel during ladle treatment have harmful effects on the casting process (clogging problems) as well as on the final mechanical properties of a steel product. Therefore, much attention is paid to control the formation and growth of clusters in liquid steel during ladle treatment. This is especially important in the production of high quality alloyed steels such as stainless steels. It is also known that the oxide inclusions of rare earth metals (REM) tend to form clusters in these steels. Therefore, the formation and behavior of clusters in the liquid stainless steel after REM additions were investigated.

The last years it has been found that the three-dimensional (3D) investigations of clusters on a film filter after electrolytic extraction dissolution of steel samples have major advantageous in comparison to the conventional two-dimensional (2D) investigations on polished cross sections of metal sample. Therefore, the 3D method was used in present study for an in-depth investigation of the characteristics of clusters in steel samples taken from liquid steel at different holding times after an addition of misch-metal. Specifically, non-metallic inclusions and clusters of REM-oxides were extracted from metal specimens using a 2% TEA electrolyte. Thereafter, they were investigated in 3D on a surface of a film filter by using SEM.

The obtained results were used to discuss the mechanisms of formation and growth of REM-clusters in liquid steel during ladle treatment. The cluster size distributions obtained from 3D investigations were used for estimations of the largest size of clusters in a larger volume of the melt. It was found that the estimation of the largest clusters depend on the mechanisms of formation and morphology of clusters. This dependence is more prominent for the samples with longer holding times. In addition, all REM-clusters in samples taken at longer holding times can be divided into two different groups having different morphologies and sizes. This may be explained by the different possible mechanisms of formation and growth of clusters from these two groups, which is discussed in this study.

Co-authors: **Andrey Karasev, Pär G. Jönsson**