Mgr inż. Hanna Suchan

Czestochowa University of Technology

Faculty of Production Engineering and Materials Technology

Abstract of doctoral thesis

The dissertation focus on impact of the feeding stream created by ladle shroud on behaviour of liquid steel and interaction between phases: liquid steel-tundish slag-air during continuous steel casting (CSC) process. A literature review showed that feeding stream is a factor which has a relevant impact on tundish work. Stream flowing to the tundish is not only significant for an impact zone, but throughout its evolution is forming behaviour of liquid steel in a whole tundish. Moreover, feeding stream can cause negative interactions on a liquid steel-slag interface, what can lead to slag emulsification, washing slag from the steel surface and expose steel to air. Therefore it is crucial to control feeding stream behaviour in the aim of receiving flow with the highest share of active flow (especially plug flow), but also receiving liquid steel hydrodynamics decreasing negative interactions between continuous phases: liquid steel-slag-air. Achieving these issues is possible by using flow control devices but also, as a literature review showed, by replacing them by special constructions of ladle shroud.

As a part of doctoral thesis the author of the dissertation designed 5 constructions of multiport ladle shrouds, which were immersed to a depth 0,1 and 0,4 m in a one-strand and two-strand tundishes. On a basis of numerical and physical simulations having done on a single phase system, the achieved results of hydrodynamic of liquid steel and share of individual flows let to choose ladle shrouds which showed the best hydrodynamics for both tundishes. Afterwards, numerical and physical simulations on a multi-phase system have been made. They presented interaction between continuous phases (liquid steel-slag-air) co-existing in a tundish during CSC process under the influence of projected ladle shrouds. The universality of usage new construction of ladle shroud in tundishes with different shape and tonnage under different casting conditions was also analysed. The choice of the best working ladle shroud have been made on a base of meeting the requirements:

- Lowering percentage share of stagnant flow;
- Minimalising area of created tundish open eye.

Carried researches confirmed possibility of universal usage of ladle shroud in a one-strand and two-strand tundishes during different casting conditions, taking into consideration above mentioned requirements.

Besides theoretical and practical part, the dissertation consists of conclusions, list of figures, list of tables and list of references.