

Importance of combined cleaning filter systems for removal of non-metallic inclusions in 42CrMo4 steel

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Combined cleaning filter systems for metal melt filtration combine reactive filtration by functionalized filter surfaces for chemical reaction with the melt with active (mechanical) filtration [1,2]. In the present work, 42CrMo4 steel was molten in a steel casting simulator and endogenous inclusions were generated artificially before filtration [3]. The generated non-metallic inclusions were investigated in detail in the solidified steel by an automated scanning electron microscope, nanoindentation, atomic force microscope and focused ion beam technique. The combined filter systems were found to strongly influence the observed inclusions. Of particular interest is the development of non-metallic multiphase particles, which take up smaller impurities in a low-melting spessartine matrix. Due to their small size and low hardness, these particles seem to affect the mechanical properties of the steel much less than pure alumina inclusions.

Keywords:

Steel melt filtration, nonmetallic inclusions, ASPEx, Nanoindentation, AFM, FIB

References:

- [1] Aneziris, C.G., Dudczig, S., Hubáľková, J., Emmel, M., Schmidt, G., Alumina coatings on carbon bonded alumina nozzles for active filtration of steel melts, *Ceramics International* 39(3), 2013, 2835–2843
- [2] Aneziris, C.G., Dudczig, S., Emmel, M., Berek, H., Schmidt, G., Hubalkova, J., Reactive Filters for Steel Melt Filtration, *Advanced Engineering Materials* 15(1-2), 2013, 46–59
- [3] Wagner, R., Schmiedel, A., Dudczig, S., Aneziris, C.G., Volkova, O., Biermann, H., Weidner, A., Tailoring Nonmetallic Inclusions in 42CrMo4 as a Preparative Tool for Active and Reactive Steel Melt Filtration, *Advanced Engineering Materials* 2021, 2100640