

Contribution ID: 39

Type: Oral

Comparison of methods for modification of oxidic non-metallic inclusions using alkali elements on a laboratory scale

Thursday 9 October 2025 11:20 (20 minutes)

The cleanness of modern steels is of utmost importance as non-metallic inclusions can have detrimental effects on the mechanical properties of the finished product, as for example fatigue strength or notched impact toughness. Especially, hard NMI have a lower formability than the surrounding matrix, which can lead to crack initiation in the material during forming. Additionally, NMIs often lead to problems during production, as for example clogging phenomena. Cleanness-sensitive steel grades are typically deoxidized not by additions of aluminum but rather by silicon or manganese deoxidation to avoid the formation of large amounts of hard and non-deformable alumina inclusions. Nonetheless, these particles cannot be avoided completely and still pose serious threats to the quality of the steel, even in low numbers. To counteract this, the second possibility of dealing with unwanted NMI is to change their chemical composition and with that influence the mechanical properties like hardness and deformability. Previous research indicated that alkali elements could possibly achieve modification of oxidic particles, leading to a reduction in hardness. Modification has been verified theoretically by thermodynamic calculations using FactSage. Building on this, different methods of NMI modification using alkali elements were developed and compared in the course of this work. First promising results of alkali-modification using carbonatic sodium and potassium and respective modification rates are presented. Future work will show the impact of this modification on the mechanical properties of the inclusions and the steel.

Primary author: PREISSER, Nikolaus (CDL-IMAS, Montanuniversität Leoben)

Co-authors: SUPPAN, Benjamin (CDL-IMAS, Montanuniversität Leoben); Dr KLÖSCH, Gerald (voestalpine Stahl Donawitz GmbH); Prof. MICHELIC, Susanne (CDL-IMAS, Montanuniversität Leoben)

Presenter: PREISSER, Nikolaus (CDL-IMAS, Montanuniversität Leoben)

Session Classification: Control and modification of the non metallic inclusions

Track Classification: Steelmaking - Oxygen steelmaking