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EAF - Trials with Scrap and solid iron in a 6 tonnes pilot furnace

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Tata Steel Netherlands (TSN), aims to reduce the CO2 emission by 40% and enhance circularity by increasing the scrap usage to 30% by 2030. These targets will be achieved by replacement of one blast furnace with an Electric Arc Furnace (EAF) which utilise Direct reduced iron (DRI) and scrap as charge material.Increasing scrap usage in EAF steelmaking is essential for enhancing circularity and reducing CO_2 emissions. However, recycling scrap introduces tramp and residual elements (TREs) such as Cr, Cu, Mo, Ni, Mn, P, S, and N, which pose challenges for maintaining steel quality. Therefore the type and proportion of input charge materials are crucial in controlling the TREs in the future EAF operation.

This study investigates the distribution of TREs among steel, slag, and fume dust during Electric Arc Furnace (EAF) processing, based on trials conducted in a 6-tonne pilot EAF at the Materials Processing Institute. It also compares the effect of using solid pig iron sourced from Blast furnace (BF) and Hisarna process as part of the charge material on refining performance and foaming behaviour in the EAF.

Two melts were performed with solid iron (either sourced from BF or Hisarna process) and clean scrap to assess refining with different starting carbon levels, tramp element dilution, and slag behavior. Results highlight the influence of initial melt chemistry and operating conditions—such as carbon content, oxygen blowing, and slag basicity—on refining reactions (de-C, de-P, de-S, de-N) and slag evolution. High carbon levels in the melt promoted nitrogen removal via CO bubble formation, while low silicon and manganese were critical for effective decarburization. Further the behaviour of nitrogen refining and its relation with decarburisation and surface active elements like sulphur concentration has been analysed through a simplified kinetic model.

Phosphorus removal was observed to be limited by low slag basicity and FeO content. The lower C content and the higher oxygen levels, in the steel, were observed to contribute to the removal of S. Tramp elements largely remained in the steel, besides Cr that partially oxidized to the slag phase. Slag composition varied significantly with oxygen blowing, affecting FeO and P_2O_5 levels and foaming behavior. These findings provide insights into optimizing future EAF operations for improved control of TREs and refining efficiency.

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Track Classification: EEC 3 - Materials and Raw Materials: EEC 3.B Use of alternative iron sources like DRI, HBI (Hot Briquetted Iron), and pig iron