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Experimental Assessment of Granulated EAF Slag for blasting operations as sand substitute in steel production

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The decarbonization of the steel industry is accelerating the transition toward production routes such as direct reduced iron (DRI), hot briquetted iron (HBI), hydrogen plasma smelting reduction (HPSR), and electric smelting technologies. As a consequence, the volume and typology of electric arc furnace (EAF) slags generated across the steelmaking chain are expected to increase significantly. Identifying high-value reuse pathways for these by-products is therefore essential to support circular-material strategies and reduce the environmental burden associated with primary raw material consumption. This study investigates the technical feasibility of employing granulated EAF slag as a substitute for blast sand in mechanical descaling operations for steel products.

A systematic characterization of 3 granulated EAF slag samples was conducted to establish their mechanical and physical suitability for abrasive blasting. The evaluation encompassed hardness, crushability, stiffness, bulk density, granulometric distribution, and morphological features obtained through optical and scanning electron microscopy. These properties were benchmarked against industrial sand commonly used in descaling processes. Based on this screening, a preliminary slag formulation exhibiting the most favorable hardness–fracture resistance balance is selected for experimental validation.

Blasting trials were performed using a controlled air-jet apparatus designed to propel abrasive particles onto carbon-steel plates of two grades representative of hot-rolled product surfaces. Test conditions varied in abrasive composition (sand, slag, and slag–sand blends), particle size classes, carrier air flow rate, and initial scale layer thickness. The thermal response of the metallic substrate during blasting was also monitored to assess potential process-induced heating. Post-treatment surfaces were examined using scanning electron microscopy (SEM), profilometry, and comparative image analysis to quantify scale removal efficiency, surface roughness evolution, and morphology of the residual oxide layer.

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Speaker Country

Italy

Speaker Company/University

Rina Consulting - Centro Sviluppo Materiali

Primary authors: D'AMANZO, Edoardo (Rina Consulting - Centro Sviluppo Materiali); CIRILLI, F (Rina Consulting Centro Sviluppo Materiali)

Presenters: D'AMANZO, Edoardo (Rina Consulting - Centro Sviluppo Materiali); CIRILLI, F (Rina Consulting Centro Sviluppo Materiali)

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