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# Tenova's Dry-Granulation System for Ladle Furnace Slag (Slag2Build Project)

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Ladle Furnace Slag (LFS) remains one of the least valorised metallurgical by-products in the European steel sector due to its unfavorable mineralogical structure generated by slow air cooling. This conventional Best Available Technique (BAT) produces γ-dicalcium silicate, leading to high dusting rates, significant water consumption, and limited external reuse. To address this bottleneck, Tenova has engineered and patented (EP4100551A1) a forced-air dry granulation technology that thermally stabilizes LFS into a hydraulically active β-$C_2S$-rich granulate, enabling its use in construction materials. Within the EU project Slag2Build, Tenova's role focuses on the design, scale-up, and industrial integration of this technology into a full-scale demonstrator at the Stomana steel plant.

The purpose of this work is to demonstrate that Tenova's granulation process can achieve TRL8 industrial operation, reaching a continuous throughput and providing a stable, quality-controlled granulated product suitable for downstream applications (plasters, mortars, hydraulic binders).

The technical framework is based on high-momentum forced-air impingement, where a controlled air jet intersects the liquid LFS stream during pouring. Rapid quenching suppresses γ-$C_2S$ formation and preserves β-$C_2S$, while simultaneously eliminating water use, reducing sulphur-rich fumes, and preventing dust formation. The system integrates thermos-fluid dynamic design principles, slag rheology modeling, heat-transfer analysis, mechanical design, and process control algorithms to ensure consistent granule morphology and temperature regimes.

The methodology for the basic and detailed engineering of the key components of the dry-granulation system requires an extensive programme of computational modelling. The present work reported the results from CFD simulations are employed to characterise the multi-phase interaction between the pressurised air jets and the molten slag stream, to analyse the associated thermal gradients and solidification kinetics, and to predict particle residence times and resulting granulometry. The numerical models developed by Tenova are subsequently validated through experimental campaigns conducted at the pilot-scale granulation facility installed at RINA-CSM (Rome), where controlled trials on representative ladle furnace slag enable direct comparison between simulated and observed granulation behaviour. Full slag characterization before and after the granulation pilot test is performed.

This research is conducted within the framework of the Slag2Build project (RFCS –GA 101193261)"

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