Inerting and upcycling of foundry fines

Chahinez Aissaoui, Université de Lorraine, FR

Abstract

The manufacture of metal foundry products requires the use of sand moulds which are destroyed, and new ones made each time metal is poured. However, recycled sand requires a regeneration process that produces a polluted fine mineral phase. Particularly rich in heavy metals and organic residues, this foundry co-product is disposed of in hazardous waste landfills and requires an expensive stabilisation process.

This paper presents the results of a research that valorises this fine fraction of foundry sands by inerting it in a cement phase. The fines are taken from the bag filter suction systems of a foundry. The sample is in the form of filler, with a fraction of less than 140µm, the D_{50} is 43µm. The Blaine fineness is 3120 cm^2/g, the fines are composed mainly of SiO_2, Al_2O_3 and Fe_2O_3. The loss on ignition at 1000°C of this material is 20%.

The chosen inerting technique is to manufacture cement pastes which, once hardened, will be crushed for use as artificial aggregates in new concrete formulations. Different percentages of volume substitutions of portland cement were tested: 30, 50 and 65%. The substitution rates were chosen to obtain the highest possible recycling rate while satisfying the European discharge limits (these values are assessed by leaching). They were also optimised by adding water-reducing admixtures to increase the compressive strengths of the mixes.

Recent Publications

Alonso-Santurde, R., Coz, A., Viguri, J. R., & Andrés, A. (2012). Recycling of foundry by-products in the ceramic industry : Green and core sand in clay bricks. *Construction and Building Materials*, *27*(1), 97-106. https://doi.org/10.1016/j.conbuildmat.2011.08.022

Bhardwaj, B., & Kumar, P. (2017). Waste foundry sand in concrete : A review. *Construction and Building Materials*, *156*, 661-674. https://doi.org/10.1016/j.conbuildmat.2017.09.010

de Matos, P. R., Pilar, R., Bromerchenkel, L. H., Schankoski, R. A., Gleize, P. J. P., & de Brito, J. (2020). Self-compacting mortars produced with fine fraction of calcined waste foundry sand (WFS) as alternative filler : Fresh-state, hydration and hardened-state properties. *Journal of Cleaner Production*, *252*, 119871. https://doi.org/10.1016/j.jclepro.2019.119871

Ganesh Prabhu, G., Hyun, J. H., & Kim, Y. Y. (2014). Effects of foundry sand as a fine aggregate in concrete production. *Construction and Building Materials*, *70*, 514-521. https://doi.org/10.1016/j.conbuildmat.2014.07.070

Gong, X., Jiang, W., Hu, S., Yang, Z., Liu, X., & Fan, Z. (2021). Comprehensive utilization of foundry dust : Coal powder and clay minerals separation by ultrasonic-assisted flotation. *Journal of Hazardous Materials*, *402*, 124124. https://doi.org/10.1016/j.jhazmat.2020.124124



Biography

Chahinez AISSAOUI is a PhD student in Materials Science at the University of Lorraine in France affiliated to the Jean Lamour institute (IJL) laboratory. She works with the Materials for Civil Engineering team for the durability of structures in Civil Engineering and in the development of new technologies that allow the recycling of industrial co-products.

Email: chahinez.aissaoui@univ-lorraine.fr

Notes/Comments: None