Physical-chemical characterization of the granulometric fractions of the granulated blast furnaces slag of Arcelor Mittal Tubarão
Silva, M.F.(1); Orlando, M.T.(1); Galvão, E.S.(1); Dieguez, A.O.(2); Magalhães, D.C.(3); Martins, J.R.(3);
Universidade Federal do Espírito Santo(1); Universidade Federal do Espírito Santo(2); Universidade Federal do Espírito Santo(3); Instituto Federal do Espírito Santo(4); ArcelorMittal Global R&D Brazil(5); ArcelorMittal Global R&D Brazil(6);

Granulated blast furnace slag (GBFS) has been used in the cement industry for decades, being this its main application. This study focus on the physical-chemical characterization of the granulometric fractions of GBFS, aiming to verify the possible technological applications, thus increasing the use rate of slag in other industry sectors, conserving natural resources and obtaining the effective utilization of industrial waste to sustain industrialization. To this extent, samples from three blast furnaces were analyzed. More specifically, six samples were collected, two of each blast furnace. Initially, the samples passed through a coarse sifting and then by a fine sifting, totaling eight sieves in sequence that have opening diameters ranging from 4800 to 75 micrometers. Each retained granulometric fraction was separated and had its weight measured by a semi-analytical weighing-machine. The granulometric fractions of the retained slag were macerated in the ring mill and afterwards passed through a 75 micrometers sieve, hence obtaining a powder with the same granulometry for all fractions. This powder was subjected to elemental analyses by X-ray fluorescence. Each fraction was analyzed, identifying the variation of its chemical composition. With the data obtained in the granulometric analysis combined with the composition from the fluorescence analysis, it was verified the existence of a similar granulometric distribution pattern for the three blast furnaces. Moreover, they present a homogeneous region of composition when the grain diameter ranges from 4800 to 75 micrometers, which corresponds to approximately 98.5% of the GBFS mass. It was observed that in this homogeneous region the elements with the greatest mass percentage are calcium, silicon and aluminum, which represent approximately 95.9% of the slag analyzed via X-ray fluorescence. In this elementary analysis, carbon and oxygen were not detected, and as a consequence, the relative percentage of the other elements increase, such as calcium, which has an average percentage of 64.0%. With the study’s results, it can be affirmed that with the reduction of the grain size, there is an increase in the concentration of calcium and sulfur, indicating a suitable qualification for the cement industry. Also, it has been shown that with a grain size greater than 4800 micrometers, there is a richer composition of silicon, aluminum and iron which, after a magnetic separation, would be indicated for the glass and refractory industry. This study points out in an innovative way that the granulometric separation qualifies granulated blast furnace slag for other industry demands, adding product value.