RELATIONS BETWEEN LEACHATED COMPOUNDS AND RAMAN SPECTRUM OF BLACK SLAGS FROM EAF IN ORDER TO CHARACTERIZE THEM. L. Gómez-Nubla [1], J. Aramendia, S. Fdez-Ortiz de Vallejuelo, K. Castro and J. M. Madariaga. Department of Analytical Chemistry, University of the Basque Country (UPV/EHU), P.O. Box 644, E-48080 Bilbao, Basque Country, Spain. Tel.:+34 94 601 82 97; Fax: +34 94 601 35 00
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The black slags are a by-product of the steel fabrication. In this case they are produced in the fusion process by means of Electric Arc Furnace (E.A.F.). This type of material has a high strength and due to its durability and chemistry has been used as construction material and more recently, as a cement additive, landfill cover material, and for agricultural applications [1-3]. In spite of this fact, they present some difficulties due to their volume instability and leaching of elements from them. So it should be considered the possible impact in soils and nearby drinking or surface waters where black slags have been used [4, 5] or deposited in dumping sites.

In this study have been analyzed samples from two different industries: ordinary steel industry and special steel industry. In both cases, original and treated black slags were provided us. The ordinary steel treatment consisted of outdoor cooling, water, crushing, sifting and magnetic separation of ironed materials. In the case of special steel treatment, it was only based on cooling outdoor and water. Apart from these, some black slags were picked up in two locations of Vizcaya (Basque Country, Spain). These samples were considered treated due to were collected in construction works, and in order to be used they must be subject of treatment according to the legislation [6].

It was carried out a molecular characterization of all these black slags through Raman Spectroscopy Renishaw RA 100, (Oxford, UK) and an InnoRaman ultramobile spectrometer (B&WTEK$_{INC}$, Newark, USA). The spectrums indicated a bigger presence of hydroxides in treated slags than in the slag without treatment: lepidocrocite, goethite, limonite, etc.

Moreover, it was realized a leaching with Milli-Q water as extractant to reproduce the conditions that are given in the nature. The concentrations of released elements from the black slags were obtained by means of Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and ionic chromatography (CI). With these data was made a statistical treatment: correlation analysis between cations (Al, Ba, B, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Sb, Sn, Sr, Ti, V, W, Zn and Ca) and anions (F^-, Cl^-, NO_3^- and SO_4^{2-}). It was compared which cations and anions were relationated with the compounds identified in the Raman spectrums obtained previously. It was observed, among others, a high correlation between iron and calcium, boron and barium, nickel and iron, sulfate and calcium… This last correlation corroborated the presence of gypsum ($CaSO_4$) appeared in the Raman spectrum .

Finally, it was made a parallel valoration with H_2SO_4 and NaOH, in order to determinate the carbonates contained in the black slags. After that, it was speculated about the acid gas attack over these carbonates, forming compounds that with the leaching could arrive to unbalance the environmental where the black slags had been deposited [7].

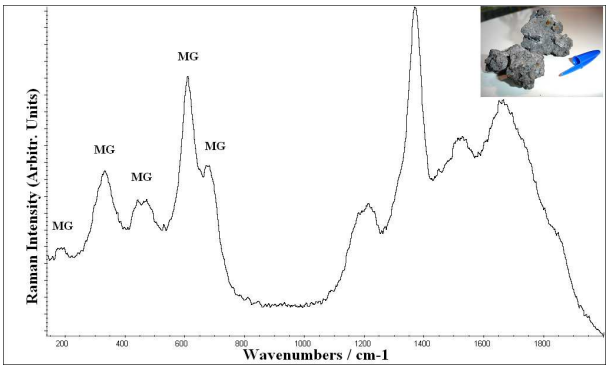

Figure 1. Raman spectrum of magnesioferrite (MG) together with typical silicates Raman bands of the black slags (right side).

References

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