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Characterization of steel mill electric-arc furnace dust

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Abstract

In order to make a complete characterization of electric-arc furnace (EAF) dust, as hazardous industrial waste, and to solve its permanent disposal and/or recovery, bearing in mind both the volumes formed in the Croatian steel industry and experiences of developed industrial countries, a study of its properties was undertaken.

For this purpose, samples of EAF dust, taken from the regular production process in the Å½eljezara Sisak Steel Mill between December 2000 and December 2001, were subjected to a series of tests.

The chemical composition of EAF dust samples was investigated by means of a several different analytical methods. The results from the chemical analysis show that the approximate order of abundance of major elements in EAF dusts is as follows: Fe, Zn, Mn, Ca, Mg, Si, Pb, S, Cr, Cu, Al, C, Ni, Cd, As and Hg.

Granular metric composition of single samples was determined by applying sieve

Granular-metric composition of single samples was determined by applying sieve separation. Scanning electron micro-structural examination of EAF dust microstructure was performed and results indicated that all twelve EAF dusts were composed of solid spherical agglomerates with Fe, Zn, Pb, O, Si and Ca as the principal element.

The investigation of grain morphology and the mineralogical composition of EAF dust were taken by combination of high resolution Auger electron spectroscopy (HR AES), X-ray photoelectron spectroscopy (XPS) and X-ray powder diffraction analysis. The analysis of XPS-spectra determined the presence of zinc in the form of ZnO phase and the presence of lead in the form of PbO phase, i.e. $PbSO_3$/$PbSO_4$ forms.

The results of the X-ray diffraction phase analysis show that the basis of the examined EAF dust samples is made of a mixture of metal oxides, silicates and sulphates.

The metal concentration, anions, pH value and conductivity in water eluates was determined in order to define the influence of EAF dust on the environment.

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Keywords

Metallurgical waste; EAFD; Characterization; Leaching; Chemical analysis

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