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Zinc Production From EAF Dust at Cape Gate — A Case Study

M. Maccagni[(1)], E.Guerrini[(1)], J. Nielsen[(2)], F. Picciolo [(3)]

[(1)] Engitec Technologies S.p.A.
Via Borsellino e Falcone, 31, 20026 Novate Milanese (MI), Italy
Phone: +39 02 382071
Email: m.maccagni@engitec.com

[(1)] Engitec Technologies S.p.A.
Via Borsellino e Falcone, 31, 20026 Novate Milanese (MI), Italy
Phone: +39 02 382071
Email: e.guerrini@engitec.com

[(2)] Engitec USA 813 Marti Drive, 31, Rolla, Missouri, MO-65401, USA
Phone: +1 573.202.9911
Email: jnielsen@engitec-usa.com

[(3)] Cape Gate (PTY) LTD
Nobel Boulevard, NE3 Vanderbijlpark, 1900, Gauteng, South Africa
Phone: +27 16 980 2118
Email: PicciolF@capegate.co.za

INTRODUCTION

Zinc is contained in numerous wastes and secondary raw materials that can be considered easily exploitable high zinc sources. However, only a portion of this material is currently processed while much of it is landfilled with or without stabilization processes. Some pyro metallurgical processes were developed to convert zinc into crude zinc oxide (CZO) and are currently the main recycling option. The zinc bearing materials are usually subjected to a thermal treatment [1] in which the zinc is vaporized and re-oxidized producing crude zinc oxide (CZO). This CZO also contains high concentrations of heavy metals and halides. Many potential crude zinc oxide feed sources, such as electric arc furnace (EAF) dust, galvanizing ashes, brass foundry and converters fumes, usually contain chlorides, fluorides and alkali metals that will be transferred to the produced crude zinc oxide. This also includes the Waelz oxides [2]. The CZO must be transformed into zinc metal which, until now, is done in two main processes: the sulphate leaching and electro-winning system and the Imperial Smelting Process (ISP). ISP is facing a crisis for both technical and economical reasons that have led to the closing of most of the existing plants.

But before being fed to these processes, the CZO must be treated to eliminate or reduce the contained impurities. The halides, in particular, are noxious to these processes and must be removed. Any chlorides fed into the zinc sulphate E.W. lead to anodic chlorine evolution. This creates labour health risks and increases the anode corrosion rate, which then compromises the zinc cathode quality. The fluorides, even at very low concentrations (a few tenths of ppm), significantly impact the cathode stripping. The halides content in the CZO also causes problems in the ISP because of issues created at the condenser.

In recent years, some alternative processes for CZO treatment have been studied and put into practice. These processes have been based on a water (or Na_2CO_3 solution) wash, but they have been problematic. For these reasons, a chloride-based zinc recovery system to directly produce metallic Zn would be valuable [3,4,5]. The major drawback in the zinc chloride E.W. is the Cl_2 anodic evolution [6,7]. Conceptually, this problem can be overcome by using a cationic perm-selective membrane with H_2SO_4 in the anodic compartment to obtain O_2 evolution at the anode. This could be an elegant solution for the chloride solution coming out of a leaching of the above-mentioned materials, but some technical problems have never been overcome.

Engitec developed the EZINEX®, a hydrometallurgical process based on an NH_4Cl electrolyte and capable of producing metallic zinc directly from zinc oxide bearing materials.

