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Holistic recovery of recyclable materials from Waelz slag

Different industries consumes zinc (Zn), such as battery, cosmetics, pharmaceuticals, and metals. Due to urbanization and technological advancement, the need for efficient resource management of Zn is necessary. The most widely used Zn containing scrap recycling method is the Waelz process, particularly for electric arc furnace dust (EAFD). Approximately, the world's annual production of EAFD is 7.5 million tons with which 45 % is recycled. By effectively recovering Zn from such waste using the principles of resource efficiency and circularity, offers a sustainable solution to address the escalating demand for Zn while mitigating the environmental burdens.

Waelz Process is a pyro metallurgical technique where the Zn scrap is loaded into a rotary kiln together with a carbon-containing reducing agent at 1200-1300 oC to extract Zn. The airflow limits the penetration of oxygen from the reaction environment into the material bed. Coke and CO (products of partial carbon oxidation) convert ZnO and Zn ferrite to Zn metal. Zn is vaporize and oxidizes in the gas stream to form ZnO, which is collected on bag filters. In Europe, the Zn recovered through this process is approximately 250,000 tons/year and the slag generated is nearly 800,000 tons/year called "Waelz Slag". However, similar to other slags further utilization of Waelz slag is a problem due to the lack of environmental compatibility, especially because of the complex chemical and mineralogical composition, as a result, Waelz slag is largely landfilled, even though the iron content exceeds that of high-grade iron ores. Through a new smelting reduction method in a high-temperature furnace similar to the study previous studies, this initiative intends to revolutionize Waelz slag recycling. The project hope to overcome the limits of old approaches by adopting this innovative technique, it allows to realize the full potential of Waelz slag as a valuable resource.

References

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