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Editorial

# Metal Recovery and Separation from Wastes

**Lijun Wang * and Shiyuan Liu ***

Collaborative Innovation Center of Steel Technology, University of Science and Technology Beijing, Beijing 100083, China
* Correspondence: lijunwang@ustb.edu.cn (L.W.); shiyuanliu@ustb.edu.cn (S.L.)

## 1. Introduction and Scope

With the development of society, large amounts of solid waste (slag, sludge, tailing, electronic waste, etc.) are generated every year. Each type of waste contains specific metals, such as As, Cr, V, Cu, Pb, and Zn, which are valuable resources and are also harmful to the environment. Currently, problems regarding the environment have increasingly attracted widespread attention as the global interest in these issues increases. If the metals in waste are not recovered effectively, not only are the resources wasted, but the environment is also seriously polluted.

The current processes for recovering metals (V, Cr, Ti, Fe, Mn, Pb, Zn, Cu, Ni, Co, Al, As, Nb, Mg, Au, etc.) from wastes (slag, sludge, tailing, electronic waste, etc.) include gravimetric, magnetic, floatation, pyrometallurgical, hydrometallurgical, bioleaching, chlorination, and electrolysis methods, etc. [1–3].

## 2. Contributions

Eleven research articles and three review articles were published in this Special Issue of *Metals*. The main topics covered include:

Cu from wasted CPU sockets was efficient recovered via slurry electrolysis [4]. The valuable metals (Ti, Fe, Mn, etc.) were extracted from vanadium slag by means of chlorination or an oxalic-acid hydrothermal leachate [5,6]. Karshyga et al. report the development of a technology intended to process electric smelting dusts of ilmenite concentrate with the extraction of silicon and titanium and the production of products in the form of their dioxides [7]. Fang et al. investigate the vacuum carbon reducing iron oxide scale to prepare porous 316 stainless steel [8]. Tin from Tin-bearing iron concentrate was removed via roasting in an atmosphere containing $SO_2$ and CO [9]. Mill scale and aluminum dross are the industrial wastes from steel and aluminum industries, which have high concentrations of $Fe_2O_3$ and $Al_2O_3$, respectively. Wongsawan reports the synthesis of ferroalloys via mill scale-dross-graphite [10]. Hosseinipour et al. investigate the significant factors of Se and/or Te recovery in the copper cementation process using the response surface methodology [11]. Current state-of-the-art milling methods also lead to the presence of significantly more reactive polymers still adhered to milled target metal particles. Blumbergs et al. find a novel and double-step disintegration–milling approach that can obtain metal-rich particle fractions from e-waste [12]. In order to solve the problem of solid waste pollution from basic oxygen furnace (BOF) slag, Lan et al. investigated oxidation reconstruction of BOF slag and alcohol wet magnetic separation recovery of iron. Compared with the initial steel slag, the iron grade increased by 8.22%, and the iron recovery increased by 46.38% compared with direct magnetic separation without oxidation [13]. Ti from Ti-bearing electric furnaces slag was leached by a $[NH_4^+]$-$[F^-]$ solution, providing the foundation for industrialization [14].

Vishnyakov reviews the recent developments in the recovery of vanadium and nickel from the heavy petroleum feedstock (HPF) as a raw source of metals [15]. Yudaev and Chistyakov review the efficiency and selectivity of the extractants in the recovery of metals

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from industrial wastewater, soil, spent raw materials, and the separation of metal mixtures [16]. Liu et al. reviews the research progress of chlorination in the treatment of vanadium-containing materials [17].

## 3. Conclusions and Outlook

The purpose of this Special Issue is to focus on the current state-of-the-art ideas, methods, technologies, etc., for utilizing waste. This Special Issue provides a very good reference for the effective utilization of solid wastes. To minimize production costs and environmental impacts, it will be more and more necessary to use cleaner and more economical methods to recover metals from wastes.

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