Ferrous material flow and contamination of tramp elements: toward sustainable recycling and efficient resource management

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Abstract

In recent years, the use of high tensile steel has become popular in the field of production of automobile, constructions, ship building, line pipes and so on, from the view point of economy and safety. This in turn gives rise to a demand for rare metals such as Mn, Cr and Mo which make steel materials have the properties of high-tensile strength, abrasion resistance, heat resistance, corrosion resistance and so on.

Ferrous materials are mainly accumulated in durable or semi-durable goods and widely in use as base metal. Ferrous material or products are widely in use as base metal. The total amount of iron consumption is 127,485 thousand ton, 45,850 thousand ton of which comes from scraps in Japan. End-of-Life Vehicle and ferrous material recovered from construction waste are major resources of secondary ferrous material as obsolete scraps. As the usage of scraps in steelmaking process has been increased, the accumulation impurities (Cu, Pu, Sn) which are known as "tramp elements" becomes a big problem because of their harmful effects on the mechanical properties and formability of steel products.

For more effective resource management about such types of goods, time lag between production and waste generation should be considered. The waste input-output(WIO) table is already developed to describe the interdependence among production, waste generation and recycling, and consider direct and indirect effects on both environment emissions and economic system. We propose the dynamic waste input-output model which focuses on the ferrous material stock and flow.

In Japanese iron and steel scrap market, most of scraps are classified by shapes, and the information of their component is insufficient. Here we estimate the effects of scrap sorting according to its components. Through

the scenario analysis, under the scrap sorting according to their shapes, we found that there is considerable amount of dissipative rare metals usage and the extra demand of pig iron for impurities dilution.