# Remarks on Special Issue on Iron and Steel Slag

*Masaaki IGARASHI*
General Manager, Head of Laboratories,
Advanced Technology Research Laboratories

*At steelworks, steel is made by refining pig iron that is produced by reducing iron ore. For producing one ton of steel in this process, slag is required by approximately 0.4 ton. This means that about 40 million tons of slag, the so-called iron and steel slag, is produced annually in Japan for its total amount of crude steel production, which is over 100 million tons. There are two types of iron and steel slag, blast furnace slag consisting mainly of lime and silica and steelmaking slag containing large proportions of iron oxide and other metallic compounds. These have been effectively utilized in civil engineering (as subbase course material, aggregate for concrete, raw material for cement), fertilization (as soil improver, silica/lime fertilizer), and in the sea (for restoration of kelp fields, construction of submerged breakwaters, etc.). Today, these steels are attracting growing attention as valuable recyclable resources.*

*Nippon Steel & Sumitomo Metal Corporation has conducted extensive research and development to diversify the utilization of slag more effectively. In particular, for the steelmaking slag, which widely varies in composition and properties, the company is striving to develop various new uses of slag as well as find more sophisticated applications.*

*In the conventional application of the steelmaking slag in civil engineering, the elution of free-lime (CaO) from slag and the expansion of slag caused by hydration have been the major problems, which are yet to be solved. With our advanced analytical techniques and equipment technology, however, various new methods for controlling them effectively have been developed. In addition, combining these methods with civil engineering technologies, the company has produced synergism, for example, the effective utilization of dredged soil is made possible by the use of calcia-improved soil and the prevention of liquefaction is made possible by the use of sand compaction piles.*

*On the other hand, large proportion of CaO in the steelmaking slag as well as the alkaline can effectively be used in the recycling of waste acids produced at steelworks and in the improvement of acid soils. In the areas which were severely hit by the Great East Japan Earthquake, they were also substituted for lime-based materials to remove salts from farmland and to effectively improve acid soils.*

*The rich inorganic components of the steelmaking slag have long been used for fertilizer. In Japan, where natural phosphorite does not exist, the steelmaking slag that contains a large pro-*

*portion of phosphorus (P)—an important component of fertilizer—is attracting attention as a valuable resource. In cooperation with the Administration, Japan Agricultural Cooperatives (JA), and farmers, Nippon Steel & Sumitomo Metal has successfully developed new fertilizers that have proven to be very effective.*

*With the cooperation of fisheries throughout the country and several local governments, the company is also positively engaged in the research and development on the restoration of damaged kelp grounds in coastal areas using the steelmaking slag. Restoring kelp grounds requires analyzing ultra-trace elements and adopting an effective biological approach. Therefore, with the proper guidance of experts in the related fields, the company has already achieved several remarkable results. For example, it has been found that even extremely small amounts of iron in the steelmaking slag can have a decisive effect on algal growth.*

*In Japan, iron and steel slag is one of the few resources that are abundantly available. We intend to continue with our research and development so that this valuable resource can be utilized effectively in many diverse fields. I am hopeful that this special issue will help the readers to better understand the present condition and the future direction of our research on slag.*