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# Resource Recycling and Mineral Processing in Korea

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## *Abstract*

*In the past few decades the major research activities in mineral processing has shifted from the traditional industrialized countries to various mineral producing countries such as India, South Africa, Australia, Chile, and China. The mineral processing research communities in Korea have faced a unique problem. The country is small (220,000 km$^2$) and highly populated (70 million). For its sustained economic growth, the tenth world largest economy in the South Korea alone has imported virtually all of its requirements in mineral and energy resources. With the improvement of the living standard of the people, massive construction of housing, roads, subways, and other social overhead capitals has helped the booming economic cycle. As one of the Tokyo Protocol countries, the reduction in $CO_2$ production has become a big concern for the nation.*

*At the very early stage of economic development of the country, Korean policy makers decided to build an iron and steel industry, resulting in the birth of POSCO, now one of the leading iron and steel producers in the world with its latest commercialization of the FINEX steel making process. The FINEX process utilizes fine powder of iron ore and coal, resulting in the saving of power at reduced environmental pollution. Since POSCO imports all its iron ores and coals from Canada, Australia, Brazil, China, and India, with only limestones supplied domestically, the traditional mineral processing has very little to do for the treatment of the raw materials. As the society becomes more conscious of the environments, however, the company has to find ways for the treatment of various waste byproducts properly. One of the early problematic waste byproduct was the acid cleaning waste from cold milling process. The problem was successfully resolved by recovering the fine iron oxides (100,000 t/y) from the waste stream for the final utilization of the recycled magnetic material in the electronic industry. The other steel making wastes that are being fully utilized are slags and mill scales (16,000,000 t/y). They are mainly used in the cement and construction industries.*

*About 1/3 of the electric power needed for the nation's growing economy is supplied by the coal thermal power generation in Korea. All coals are imported from Canada, Australia, China, and India. The coal thermal power generation produces various coal combustion byproducts such as fly ash, bottom ash and gypsum. At the current rate of coal power production, it is expected that over 6 million tons of coal ash will be produced in 2010. With such large increase in coal ash production in the near future, locating a new coal ash landfill site becomes a serious problem, not to mention the heavy costs for the construction of new landfill sites, including various compensation costs to the local residents in the site. Fortunately massive construction of housing, roads, subways, and other social overhead*

*capitals has required large consumption of cements. Korea produces and utilizes about 40 million tons of cement a year, one of the top cement users in the world per capita. Cement production process requires large thermal energy resources that have to be imported. One ton of cement production gives off about 1.5 tons of $CO_2$ into the atmosphere. Fortunately the fly ash possesses a unique pozzolanic property that can produce high performance concrete when it is used in combination with conventional Portland cement. All those built-in factors calls for the complete utilization of coal fly ash in the cement construction industry. It used to cost about 10 US dollars per ton of discarded coal ash for a coal thermal power plant. Now the power plants recover about 10 US dollars per ton of discarded coal fly ash. After a simple processing, the fly ash processors sell the product to the remicon industry at the profit of about 20 US dollars per ton. The final user of the processed fly ash, the remicon industry also saves about 20 US dollars per ton of fly ash, replacing the conventional portland cement. An attempt to produce fine dry bottom ash was successfully tried for the same application. Also most of the gypsum produced from the desulferization process in the power plants are being used in the housing industry. The marginal transportation cost of these recycled resources is another big contributing factor that made all these utilization possible.*

*Such full utilization of the byproducts from iron and steel mills and coal thermal power plants in Korea was only made possible through the contribution from various mineral processing research communities. Such resource recycling benefitted all industries along the downstream of the processes, freeing the country from the heavy environmental and energy burdens*