This article summarizes the presentation by Dr. Boas at the ASM Materials XXI conference last January in Cleveland.

R. C. Villas Bôas
CETEM - Center for Mineral Technology
Cidade Universitária
Rio de Janeiro, Brazil

Materials play a fundamental role in developing a nation and in maintaining or increasing its share of the world economy. However, during the course of its transformation into a product, every material has at least one extracting, processing, fabrication, and manufacturing step in which substances such as gases, liquids, or solids are released to the environment.

This article addresses a few of the environmental problems associated with the extracting and processing of some non-fuel, non-ferrous commodities that are important to the fabrication of environmentally sound products.

Materials production

Within a given framework of industrial development, the production and utilization of materials in general, especially ores and metals, obey the economic cycles that are in effect during a certain time period. These cycles have been well discussed in the literature and might reflect local or world trends, or a geopolitical trend.

The selection of a given set of materials depends on the cycle that predominates in the industrialized countries. Therefore, these cycles determine, to a greater or lesser extent, the consumption pattern of a given commodity, inducing the market to adapt itself to such a new reality. In materials-based industries, two general strategies follow: a search for materials that suit an available technology, and the development of a technology for an available material.

Recycling generally needs lower capital and energy expenditures and more manpower than that of primary processing. Also, pollution control costs are lower than those required for processing primary ores. Such recycling becomes more intense as the sophistication of the economy increases, since viable quantities of recycled materials must be available in order to re-utilize them.

As important as they are in the world's economy, materials require energy to be processed, land for factories to be installed, and disposal sites to receive tailings or wastes. Furthermore, they give off gases and dusts, and require water.

Acceptability of these requirements, of course, changes from time to time, as social pressures increase, forcing legislative decisions that promote technological alternatives which, in turn, reflect on the economy.

Average metal recoveries

For any material to be produced, discards are also produced. These discards consist of two broad categories: losses and effluents. Losses are those discards readily identified with the main material produced, i.e., parts of that material that are left behind throughout the production steps. Effluents are the discards coming from these same steps, and that are inherent to the applied technology within each production step, but not necessarily identified with the main material.