Removal of Mercury from Copper Smelter Gaseous Stream Residues

Les R. Dole, Juan J. Ferrada, and Jan B. Berry
Oak Ridge National Laboratory

Abstract

The U.S. mining industry produces over 7,000,000 tons/yr of process residue that may contain hazardous species as well as valuable by-products. Process residues are generated by (a) smelter off-gas cleaning—5,500,000 tons/yr and (b) bag house dust and wastewater treatment—2,100,000 tons/yr (U.S. Environmental Protection Agency, 1995). New approaches may be able to recover marketable by-products from this process residue to generate revenue and reduce disposal costs for the mining industry.

Oak Ridge National Laboratory in conjunction with Sepradyne, a small firm that initially developed a mercury separation process, and in collaboration with the Colorado School of Mines optimized the separation process to treat acid blowdown sludge from the copper industry. This process operates commercially at a copper mine and includes a rotary vacuum kiln. Two materials result: (1) mercury and (2) a recyclable process stream with 5–20% copper and extremely low concentrations of mercury. The mercury is sold or treated and disposed. If the "mercury-free" stream contains >7% copper, it is recycled to recover copper; if not, it is sold to recover lead and trace gold and silver.

The paper summarizes the results of interactive modeling of process and thermodynamic variables including: (1) process analysis indicating that the Sepradyne process achieves an 80% reduction in mercury with low rates of air in-leakage, (2) evaluation of the effect of air in-leakage on mercury separation indicating that a reducing environment could lower the temperature at which mercury separates from 600 to 225ºC and improving product purity.