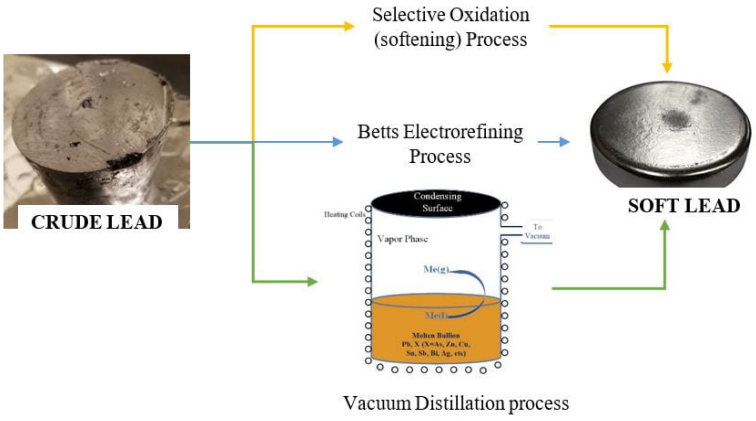
Vacuum Distillation of Complex Lead Bullion



Vacuum Distillation process

Complex lead bullions exiting the blast furnace often contain impurities such as silver (Ag), arsenic (As), bismuth (Bi), copper (Cu), antimony (Sb), tin (Sn), and zinc (Zn). Refining of such bullion is traditionally carried out via refining processes such the softening process, and the electrolytic process. Each of these process have disadvantages: the softening is very complex and the operating conditions are not the best; the electrolytic process has a long production time and consumes a lot of energy. Vacuum metallurgy has long been applied to the production of metals such as nickel and tin, and it is known to yield cleaner products, to create less pollution, and to consume less energy. This project will investigate vacuum distillation as an alternative process for the refining these complex lead bullions.

Investigation of vapor pressures for the elements of interest, it can be concluded that pure As, Zn, Sb, and Bi can be removed from pure lead while lead can be selectively removed from Cu, Ag, and Sn. The scope of this project was investigating the Pb-X alloy systems, X being Ag, As, Bi, Cu, Sb, Sn, or Zn. The effect of system pressure, system temperature, and impurity concentration in the alloy was evaluated.

Experimental considerations of this project included:

1. Thermodynamic modeling of binary Pb-X systems using thermodynamic models for the activity coefficient to produce temperature composition and pressure composition diagrams followed by the prediction of impurity removal
2. Lab scale experiments with a furnace + condenser + vacuum pump setup at different temperature and pressure resulting from 1
3. Validation of thermodynamic models
4. Preliminary flowsheet construction.

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