Review
Received January 9, 2018
Accepted for Publication April 6, 2018

Stability Diagrams for Copper-Sulfide and Copper-Recycle Systems Applied to Extractive Metallurgical Processes

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Copper sulfide from ore deposits and recycled copper from collected wastes are the two main resources for the production of copper metal. Thermodynamic calculations can be used to serve as a guide for characterization of ore deposits and their mineralogy as well as for process development by mineral processing and by waste separation. The concentrated ore and separated waste can then be processed by pyro- and/or by hydro-metallurgical operations. Such operations may be controlled by oxidation-reduction potential, temperature, complexing reagents (gas, solid or dissolved species), oxidant- reductant, and mass of components. Commonly used stab ility diagrams for aqueous system include speciation (counting alpha) and E_H-pH (Pourbaix) diagrams and, for non-aqueous systems, are partial pressure (Kellogg), binary and ternary phase, and Ellingham diagrams.

For multicomponent systems, the appropriate approach for the construction of the stability diagram is to use a complete mass balance approach rather than draw the equilibrium line between two adjacent species. Not limited to two variables, a three- dimensional diagram can also be constructed.

This paper illustrates the use of stability diagrams for investigating and interpreting how operation variables are important with a focus on extractive metallurgical operations to produce copper. Industria l operation conditions are marked on the diagrams.

Keywords : Thermodynamics copper extraction, Partial pressure diagram, E_H-pH diagram, Ellingham diagram, Binary and Ternary phase diagrams