Partitioning and Contents of Trace and Major Elements in Co-crystallized Synthetitc Sulfide Minerals: Advances of a Synthesis in Salt Melts Using a Steady-State Temperature Gradient

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Due to complex geological history of the minerals of Pb-Zn-ores (the main source of critical metals – Ga, Ge, In etc.), a quantitative relationship between their composition, physical and chemical conditions of formation and the type of deposit has not yet been established. The optimal solution is to study synthetic minerals. The synthesis method must meet several conditions: 1) the result of the synthesis should be crystals of sufficient size (~1 mm); 2) the growth should take place under stationary physical and chemical conditions to obtain equilibrium mineral associations; 3) the method should allow to change the synthesis patameters (*T*, *p*, chemical potentials, charge compositions) in wide intervals.

The method of synthesis in salt melts using a steady-state temperature gradient meets these criteria. It allows to grow joints of sufficiently large crystals of the sulfide minerals of Pb-Zn-ores. We have grown pyrite-pyrrhotite, pyrrhotite-pentlandite, arsenopyrite-pyrrhotite, sphalerite-pyrrhotite, sphalerite-galena equilibria, enriched with major and trace elements. LA ICP MS and SEM EDS analyses have shown a uniform distribution of dopant elements within a single phase and its partitioning between co-existing minerals. This method allows to synthesize chalcogenides doped with the following elements: P, K, Ti, V, Fe, Co, Ni, Cu, Zn, Ga, As, Se, Rb, Zr, Pd, Ag, Cd, In, Sn, Sb, Te, Cs, La, Hf, Re, Pt, Au, Hg, Pb, Bi, and in some cases O, Al, Si, Cl, Cr, Mn, Ge, Br, Nb and Os. Synthesis can be carried out at temperatures 370-800°C and 1 bar pressure using silica glass ampoules and at elevated pressures using Pt-ampoules.

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