

The relative stability of stoichiometrically related natural and synthetic double salts

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ABSTRACT

The so-called “simple salt approximation” is used to calculate the lattice energies of double salts (compounds that contain two or more different types of ions). Enthalpies and Gibbs energies of dissolution based upon these lattice energies are then used to estimate the solubilities of hydroxyl sulfates, hydroxyl carbonates, hydroxyl nitrates, hydroxyl chlorides, and hydroxyl phosphates. Based on the solubilities, general rules are postulated for the relative stabilities of double salts that have the same cations and anions, but in different stoichiometries. These observations provide an understanding of the relative stabilities of many minerals and guidance for the design of synthetic methods, and have been used to prepare likasite $[\text{Cu}_3\text{NO}_3(\text{OH})_5 \cdot 2\text{H}_2\text{O}]$, the zinc analog $[\text{Zn}_3\text{SO}_4(\text{OH})_4]$ of antlerite $[\text{Cu}_3\text{SO}_4(\text{OH})_4]$, and $\text{Cu}_5(\text{SO}_4)_2(\text{OH})_6 \cdot 4\text{H}_2\text{O}$.

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