



Thermodynamic Analysis and Application of Metal Carbonate Solubilities

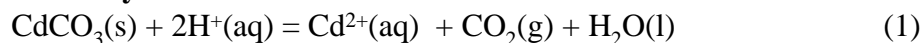
(Solubility data of compounds relevant to mobility of metals in the
environment)

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From Solubilities to Thermodynamic Quantities of Metal Carbonates

- $\Delta_f G^\circ(\text{MCO}_3, \text{s}, 298.15 \text{ K})$: The determination of standard Gibbs energies of formation of sparingly soluble metal carbonates can be based on solubility and electrode potential measurements. The same ionic medium is employed as solvent when both solubility and redox equilibria are studied. The first metal carbonate investigated by this method was otavite, CdCO_3 .

1) Solubility



$$\lg^* K_{ps0} = \lg\{[\text{Cd}^{2+}] \cdot p(\text{CO}_2) \cdot [\text{H}^+]^{-2}\}$$

$$\Delta_{\text{sol}} G^\circ = -RT \ln(10) \cdot \lg^* K_{ps0}$$

Fig. 3: Thermodynamic analysis of $\text{NiCO}_3 \cdot 5.5\text{H}_2\text{O}$ solubility

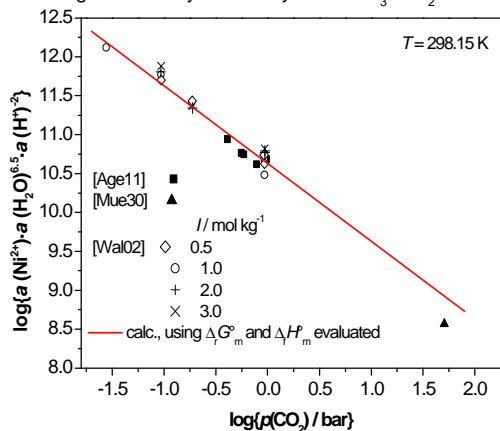
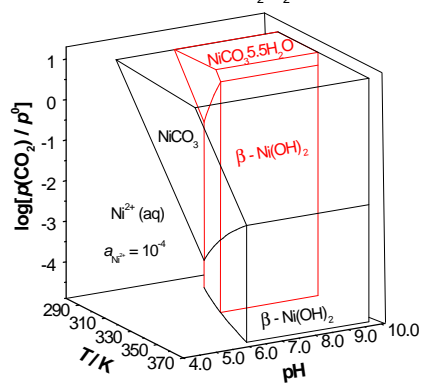


Fig. 4: Three-dimensional predominance diagram for the system $\text{Ni}^{2+}\text{-CO}_2\text{-H}_2\text{O}$



Solubility Measurements and/or Critical Evaluations are available for:

Formula	Mineral Name	Thermodynamic Analysis $?\log\{[\text{M}^{2+}] \cdot [\text{H}^+]^{-2}\} / ? \log p(\text{CO}_2)$
MnCO_3	Rhodochrosite	-1.0
FeCO_3	Siderite	-1.0
CoCO_3	Spherochalcite	-1.0
NiCO_3	Gaspéite	-1.0
$\text{NiCO}_3 \cdot 5.5\text{H}_2\text{O}$	Hellyerite	-1.0
CuCO_3	****	-1.0
$\text{Cu}_2(\text{OH})_2\text{CO}_3$	Malachite	-1/2
$\text{Cu}_3(\text{OH})_2(\text{CO}_3)_2$	Azurite	-2/3
ZnCO_3	Smithsonite	-1.0
$\text{Zn}_5(\text{OH})_6(\text{CO}_3)_2$	Hydrozincite	-2/5
CdCO_3	Otavite	-1.0