

APPLICATION OF THE SURFACE ENERGIES OF A CRYSTAL FOR THE CALCULATION OF THE RELATIVE FORMATION TEMPERATURE

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In this paper the results of the application of the Gibbs-Wulff's theorem upon some crystal morphological types and the dependence of the surface energies on temperature are presented. We obtained an expression that enables us to calculate the relative formation temperature of the {100}{111} crystal form combination for pyrite, fluorite and galena. The results for pyrite and galena crystals are presented in details.

Applying the Gibbs-Wulff's theorem on the {100}{111} crystal form combination in the cubic system we obtained the following expression:

$$X = \left[1.5 - \frac{\sqrt{3}}{2} (T_k - T)^n \right] Y$$

In this expression X is the size of the (111) planes (mm, cm); Y is the size of the (100)-planes (mm, cm); T_k is the critical temperature of the crystal formation (K); T is the unknown relative temperature of formation (K) and n is an exponent that has different values for different minerals ($n = 0.062$ for pyrite and galena etc.). The relative temperature of formation can be calculated from the above mentioned expression if we measure the values X and Y on the real crystal and if we know T_k .

The calculated values for the relative formation temperature of pyrite {100}{111} crystal form combinations from Lipe (copper deposit, East Serbia) are given in Table 1. For pyrite, T_k is 1014 K in the Fe-S system.

For galena, the {100}{111} crystal form combination expression is the same as for pyrite, but T_k is different. For galena, T_k is 989 K in the Fe-Pb-S and Pb-S systems. Table 2 presents the calculated values for the relative formation temperature of galena {100}{111} crystal form combinations from the Ravnaja Pb-Zn-deposit (West Serbia).

Table 1: Calculated relative formation temperature for pyrite {100}{111} crystal form combinations, Lipe deposit, East Serbia.

Y _{meas.} (mm)	X _{meas.} (mm)	T (°C)	Number of crystals
1.8	0.43	315	21
1.8	0.42	270	15
2.0	0.47	260	18
2.2	0.53	316	12
3.0	0.40	316	2
3.0	0.70	331	6

Table 2: Calculated relative formation temperature for galena {100}{111} crystal form combinations, Ravnaja deposit, West Serbia.

Y _{meas.} (mm)	X _{meas.} (mm)	T °C	Number of crystal
2.62	0.62	276	15
1.45	0.36	262	23
1.36	0.31	223	27