Vapor Phase Equilibria in the System Zn/P/O

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Potential applications of ZnO as a II-VI semiconductor in optoelectronics and spintronics originate the great interest in solid state physics of high-quality crystals. Despite many attempts at growing crystals by melt crystallization [1], hydrothermal synthesis [2], and gas phase transports [3,4] the experimental conditions for the growth of ZnO in high purity and crystal quality are still to improve. Within exemplary studies, the conditions of Chemical Vapor Transport reactions using different transport additions have been investigated.

Withal, vapor transports of ZnO by addition of elements of Group XV (P, As, Sb) are not as yet described. Against the background of a possible p-type doping of ZnO their feasibility and appropriate conditions for crystal growth should be investigated. Simple modelling using the electromotive series of oxides (Figure 1) reveals possible transports by addition of phosphorus and arsenic (1).

$$ZnO\ (s) + 1/6\ X_4\ (g) = Zn\ (g) + 1/6\ X_4O_6\ (g)\ (X = P, As) \qquad (1)$$

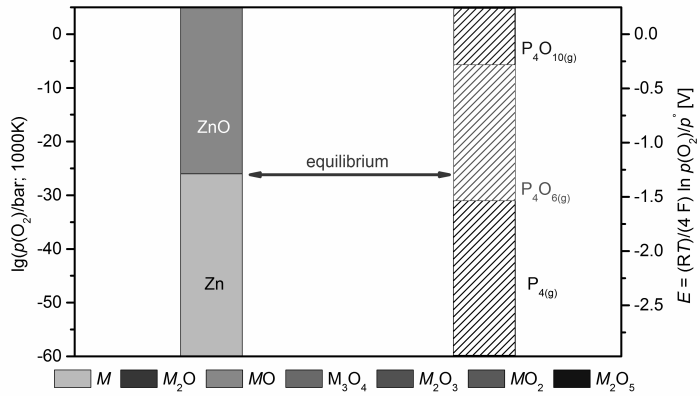

Fig. 1) Phase relations in the system Zn/P/O according to the electromotive series of oxides

The course of dissolution reaction with the addition of phosphorus has been determined by application of a high-temperature gas-phase balance [5]. Using the method heterogeneous reactions under formation of gaseous species as well as the reversible phase formation with condensation of a volatile component can be recorded [5, 6].

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