## Cubic boron nitride crystallization in fluid systems – in situ studies

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According to the equilibrium phase p,*T*-diagram of BN suggested by Solozhenko in 1988 [1], at ambient pressure cubic boron nitride (cBN) is the thermodynamically stable BN polymorph up to 1600 K. However, low-pressure crystallization of cBN in the region of its thermodynamic stability is kinetically restricted. For a rich variety of systems, the threshold pressure of cBN spontaneous crystallization is about 4 GPa irrespective of the temperature. Early in the 90s, Solozhenko *et al.* [2,3] found that synthesis of cubic boron nitride in the presence of supercritical fluids results in drastic reduction of the threshold pressure of cBN formation.

Present work is the first attempt to study *in situ* the crystallization of cubic boron nitride from BN solutions in supercritical N–H fluid at pressures up to 5.2 GPa and temperatures up to 1600 K using angle- and energy-dispersive X-ray diffraction with synchrotron radiation.

In cooling of the BN solution in supercritical N–H fluid, the disappearance of shortrange order in the solution is observed which is accompanied by the precipitation of solid phases (cBN or hBN and BN–NH<sub>3</sub> intercalation compound depending on the pressure, temperature and concentration). Spontaneous crystallization of cubic boron nitride has been observed down to  $1.9\pm0.2$  GPa, which is the lowest pressure of the cBN crystallization reported so far. Based on the results obtained, the BN–NH<sub>3</sub> hypothetical quasibinary section of the phase diagram of the B–N–H system at 4 GPa has been constructed.

A comparison between diamond and cBN crystallization has shown that for the fluidcontaining systems the position of the low-temperature boundary of cBN formation in the p,T-diagram of boron nitride is defined either by the line of the incongruent melting of the BN compound with the solvent, or by the kinetics of the cBN nucleation and crystal growth. The position of the high-temperature boundary of the p,T-region of cBN crystallization is always defined by kinetics factors.

## References:

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