Shock synthesis of non-porous samples into flat recovery ampoules

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A shock compression is used for synthesis of new materials or phase states [1]. In this method the initiating factors of synthesis are pressure and temperature, as a rule. Because of the inhomogeneity of the starting compositions and the residual porosity, the initiation of synthesis occurs in local pockets. The process develop by means of heat and mass transfer mechanisms [2]. This leads to decrease in synthesis efficiency, as a rule. In this work we attempt to address the problem of inhomogeneity through the elimination of the original porosity. The purpose of work is to create conditions for more uniform heating of the sample under shock loading. As an object for study of shock synthesis of cubic structure (\(\gamma\)-phase) of silicon nitride (\(\text{Si}_3\text{N}_4\)) from initial hexagonal structure was chosen. Earlier studies have been conducted for obtaining a \(\gamma\)-phase in recovery ampoules from mixtures of \(\text{Si}_3\text{N}_4\) with bromide [3] and copper powder at pressures up to 50 GPa [4]. In this work experiments on receiving of \(\gamma\)-phase of silicon nitride \(\text{Si}_3\text{N}_4\) in recovery ampoules under the pressures of 52–98 GPa by means of explosive lenses and flat drummers, dispersed to different velocities are made. Powder \(\text{Si}_3\text{N}_4\) with hexagonal structure was pressed in several stages into the ampoule with flat geometry. The residual porosity of the dry sample has reached 43%. Impregnation of the sample with liquid bromoform (CHBr\(_3\)) ensured the elimination of the pores.