

## Nanocomposites and nanomaterials

### Synthesis of superconducting materials in the system Mg-B-Zr at a pressure of 2 GPa

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Experimental study of the patterns of synthesis and sintering at high pressures and temperatures of materials based on magnesium diboride with the addition of Zr (powder) up to 10 wt.% was be done. The study effect of synthesis parameters were carried out in proposed in previous works (a mixture of magnesium and boron powder, taken in the stoichiometry of  $\text{MgB}_2$ , a pressure of 2 GPa, the synthesis of 1 hour), a variable number of parameters were Zr additives and temperature (700-1050 °C interval investigated ). It is shown that under these conditions, the optimal synthesis temperature is 750-800 °C range. Synthesis in these conditions is accompanied by the formation of zirconium hydride. Superconducting properties of the material significantly improved. Increasing the temperature to 900-950 ° C leads to the formation of zirconium diboride,  $\text{ZrB}_2$ , wherein the superconducting properties of this material is not substantially different from pure magnesium diboride. In addition, a comparison of samples obtained at different temperatures showed that at lower temperatures, the synthesis of the material there is a greater number of "black" phase inclusions  $\text{MgB}_{12}$ . Adding Zr contributes to the formation of more inclusions.

1. *Buzea C., Yamashita T.* Review of superconducting properties of  $\text{MgB}_2$  // *Supercond. Sci. Technol.* – 2001. – **14**. – R 115-146.
2. *Zhao Y., Feng Y., Cheng C. H., Zhou L., Wu Y., Machi T., Fudamoto Y., Koshizuka N., Murakami M.* // *Appl. Phys. Lett.* – 2001. – **8 (79)**. – p. 1154.
3. *Goto D., Machi T., Zhao Y.* Improvement of critical current density in  $\text{MgB}_2$  by Ti, Zr and Hf doping // *Physica C.* – 2003. – **392**. – p. 272–275.
4. *Prikhna T.A., Gawalek W., Savchuk Ya.M., Moshchil V.E., Sergienko N.V., Habisreuther T., Wendt M., Hergt R., Schmidt Ch., Dellith J., Melnikov V.S., Assman A., Litzkendorf D., Nagorny P.A.* High-pressure synthesis of  $\text{MgB}_2$  with addition of Ti // *Phisica C.* – 2004. – **402**. – p. 223-233.