THERMAL ANALYSIS OF DETONATION NANODIAMONDS

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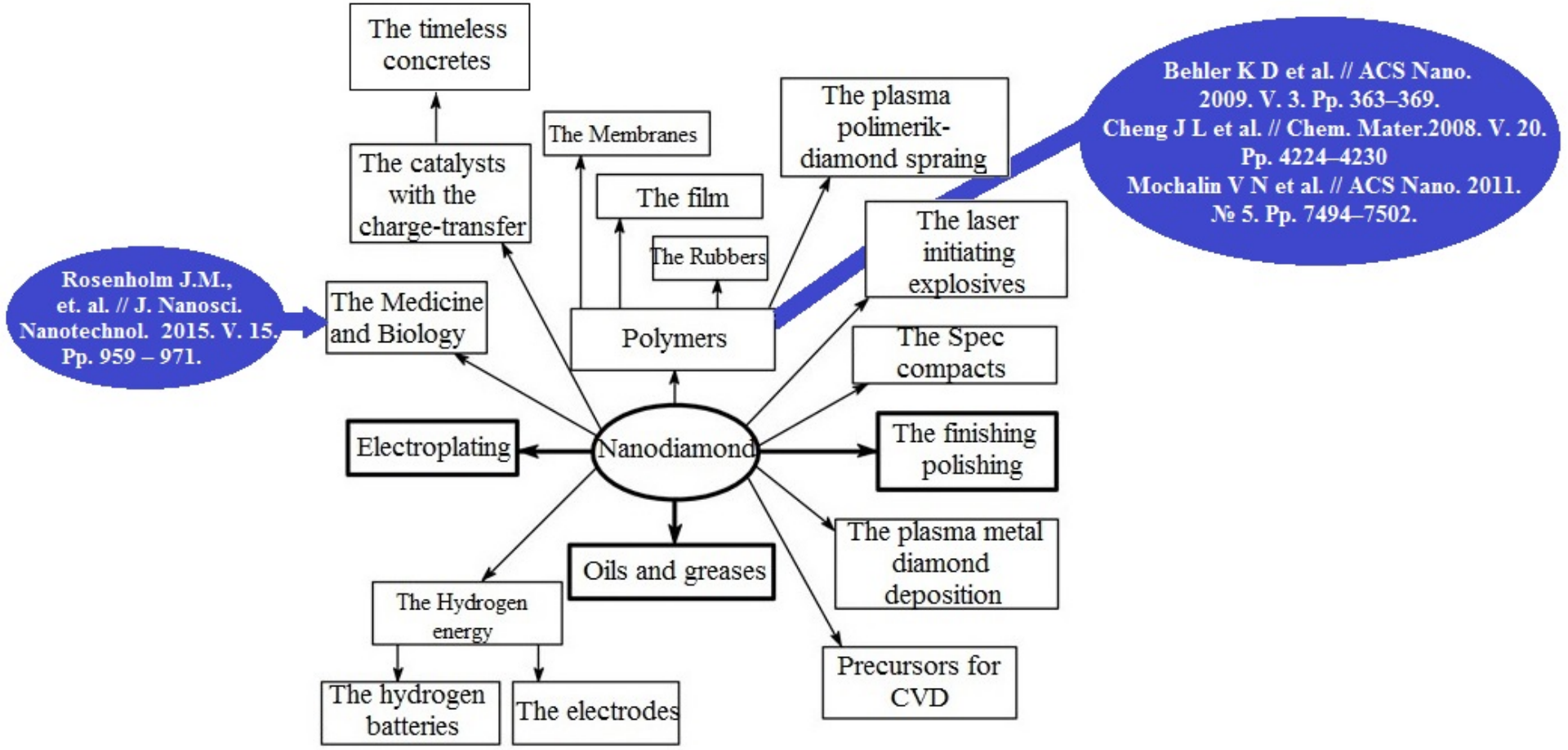
ОБЪЕДИНЕННЫЙ
ИЗТОН

THE APPLICATIONS OF DETONATION NANODIAMONDS



[1] Danilenko V. V. Detonacionnye nanoalmazy: problemy i perspektivy // Sverhtverdye materialy. 2010. № 5. S. 15-28.

The problem

Why have the wide application of the detonation nanodiamonds not been found yet?

- The laborious technology of the purification of detonation nanodiamond;
- A small percent of its content in the starting material ("diamond blend");
- The high polydispersity;
- The **main obstacle** is the non-reproducibility of the obtained product in the batches: different particle size, different chemical and functional compositions, and etc.

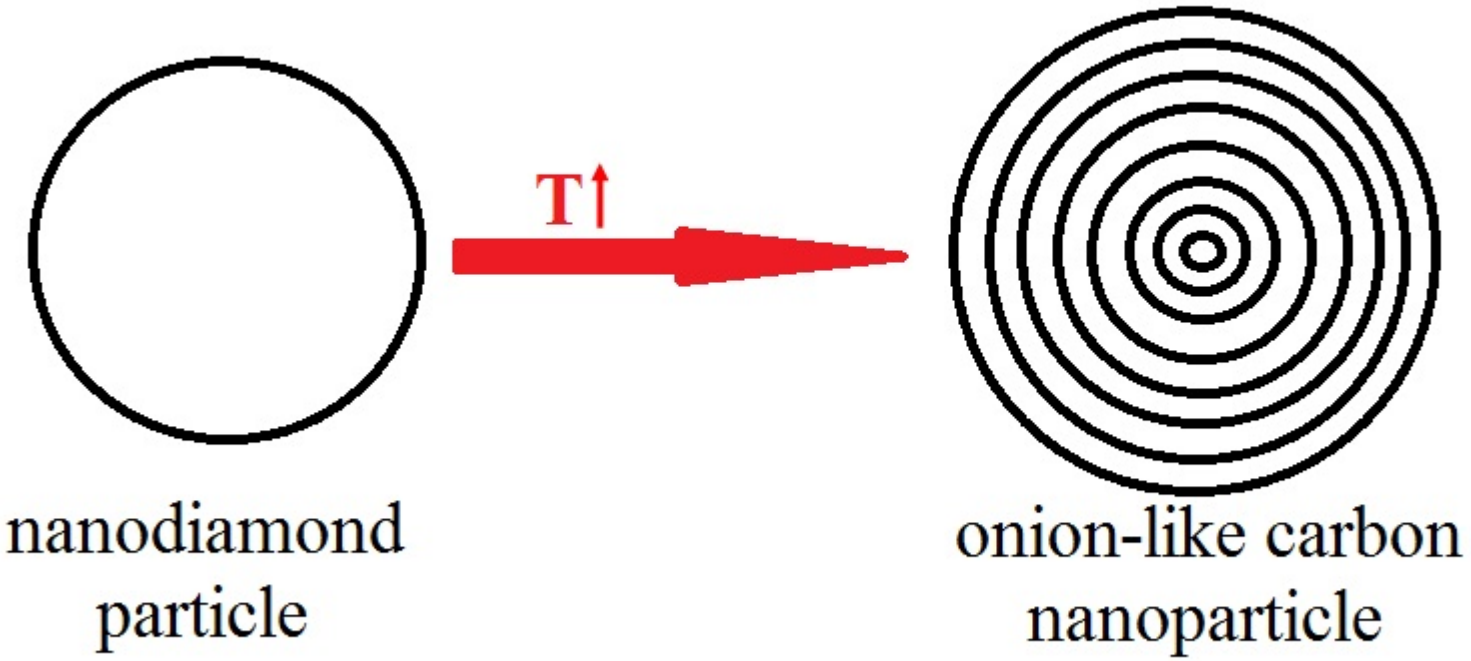
Today, the thermophysical data of the detonation nanodiamonds are enough contradictory. For composites and alloys obtaining it is necessary more special work to systematization and correction this data.

[2] Efremov V.P., Zakatilova E.I., Maklashova I.V., Shevchenko N.V. Svojstva detonacionnyh nanoalmazov pri povyshennyh temperaturah // Konstrukcii iz kompozicionnyh materialov. 2016. Will be published.

THE MOTIVATION

Temperature of the beginning of graphitization T, °C	References
670	[3] **Xu NS, Chen J, Deng SZ.** // Diamond and Related Materials. 2002. 11. Pp. 249–56.
>927	**[4] Dolmatov V. Yu** // Uspehi himii. 2001. V. 70. № 7. Pp. 687 - 708.
>800	**[5] Chen, S. Z. Deng, Jun Chen, Z. X. Yu, and N. S. Xua** // Applied Physics Letters. 1999. V. 74. № 24. Pp. 3651 - 3653.
927	**[6] Aleksenskiy A.E., Baydakova M.V., Vul A.Ya., Davyidov V.Yu., Pevtsova Yu.A.** // Fizika tverdogo tela. 1997. V. 39. № 6. Pp. 1125 - 1134.

THE MODEL OF THE DESTRUCTION NANODIAMOND PARTICLE



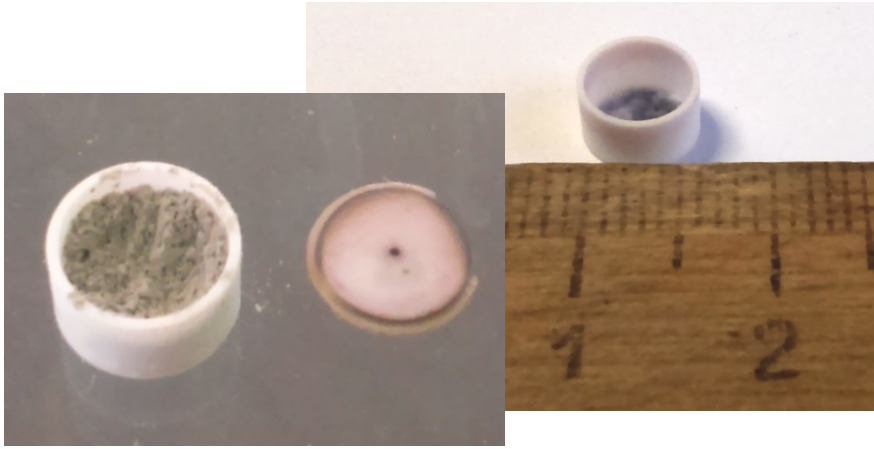
[7] Popov V.A. Metal Matrix Composites with Non-Agglomerated Nanodiamond Reinforcing Particles composites // Nova Science Publishers. 2013. Pp. 369-402

METHODS OF THE STUDY

- The *synchronous thermal analysis* (STA) which includes the *thermogravitation measurements* (TG) and the *differential scanning calorimetry* (DSC) in the device Netzsch STA 409 PC

- The X-ray diffraction

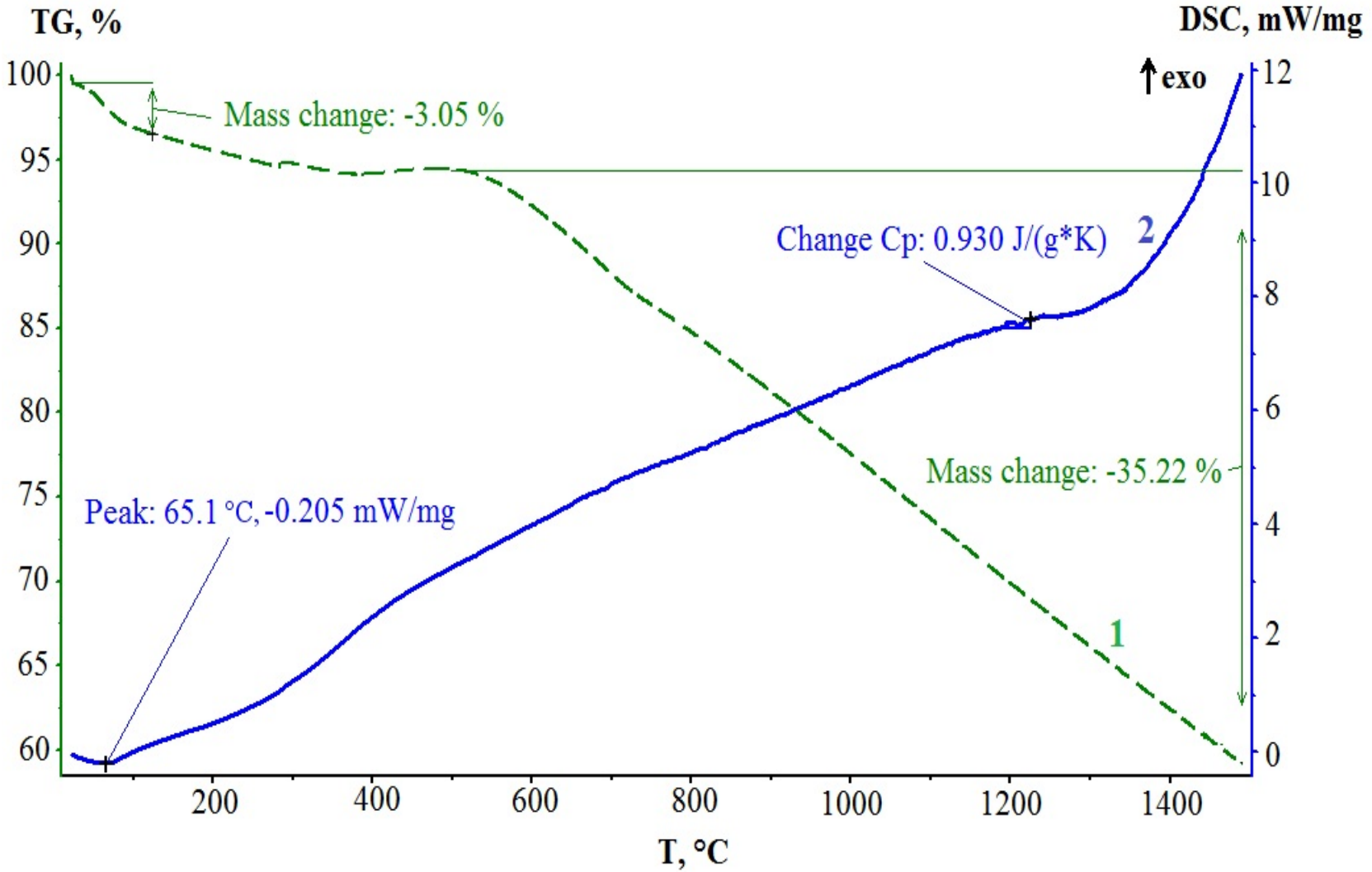
- The scanning electron microscope



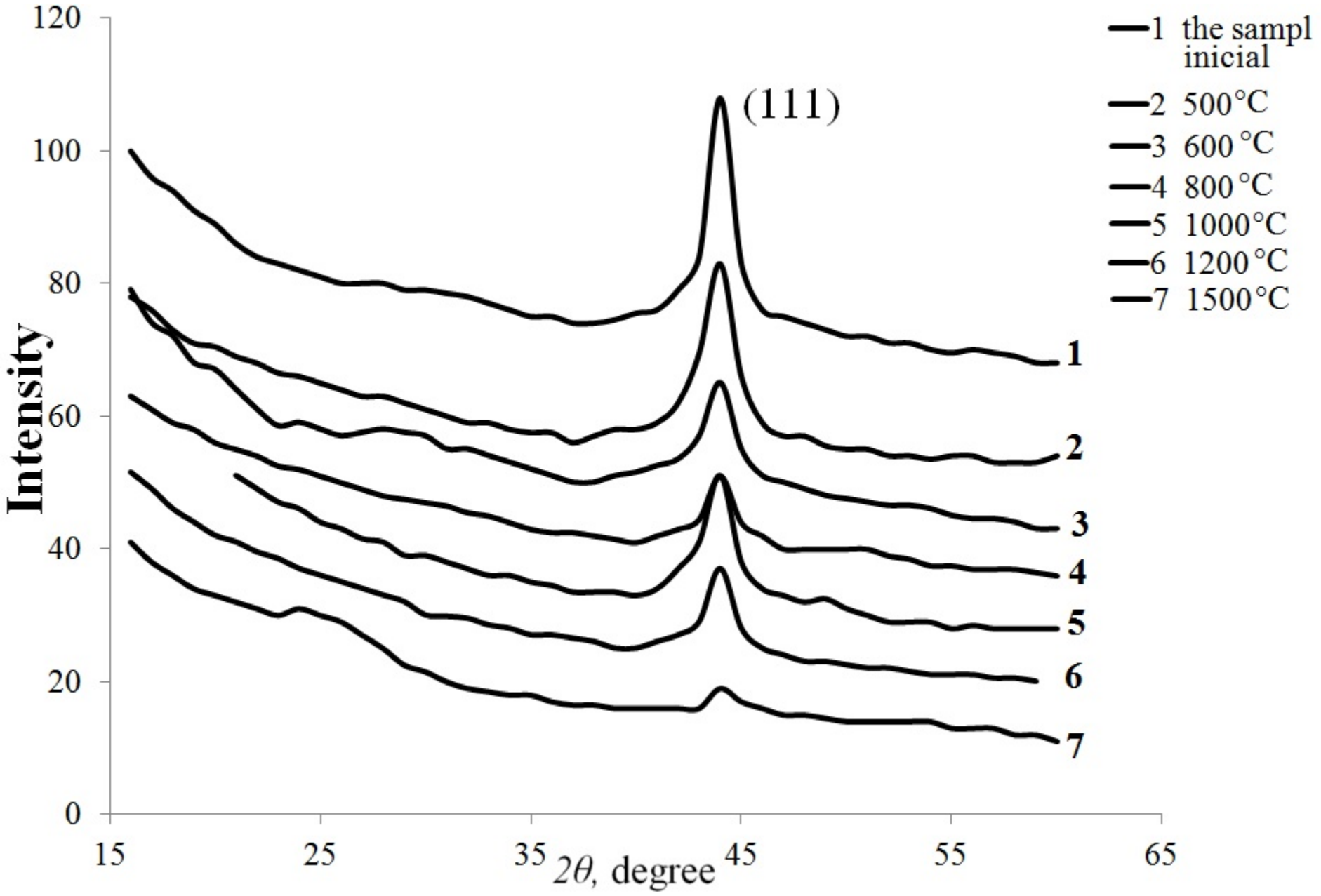
The crucible with the sample of detonation nanodiamond

Element compound of the purified detonation nanodiamond

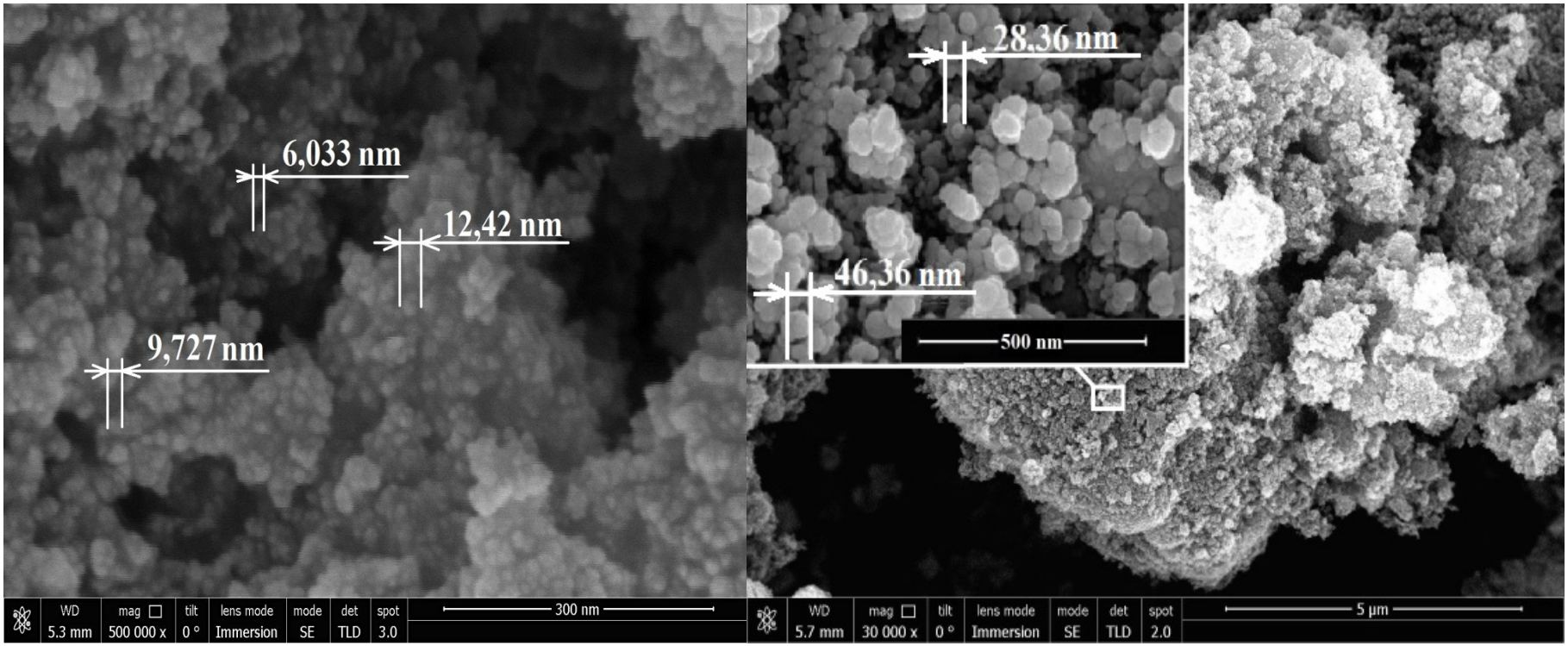
C	Fe	Cr	Ti	Ba	Cl	S	Si	Al	Cu	Ca	K	Mg	Na
98.6	0.30	0.22	0.20	0.04	0.02	0.02	0.02	0.03	0.32	0.02	0.03	0.04	0.13



Thermogram of the secondary heating of the nanodiamond powder up to 1500 ° C with the rate 10 K / min 1 - TG curve, 2 - DSC curve.



The diffractograms of the sample after the first heating with the rate 10 K/min



a) *b)*

Microstructure of the sample detonation nanodiamond before (a) and after (b) of the heat treatment (temperature 1500 °C with the rate 10 K/min).

Conclusions

- It is shown that the thermal stability of the detonation nanodiamond is higher than 1500 °C.

- The analysis of the literary data has showed a wide range of the temperature beginning graphitization of the nanodiamond powder. Nevertheless, according to our results the basic process of graphitization the nanodiamond powder occurs above 800 °C. However, after heating of the sample the content of the diamond phase decreased. This is due to the transition of the diamond to the amorphous state.

- After the heat treatment the linear dimensions of the particles powder has increased. However, the dependence of the limit stability of the nanodiamonds from the physical properties of the particles requires the further investigation.

Thank you for attention…

Obrigado pela sua atenção…

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