Contribution ID: **276** Type: **Oral**

Neutron diffraction study of nanocrystalline nonstoichiometric niobium carbide powders

Nowdays, investigation of nonstoichiometry and small particle size impact on a structure of material and therefore on its'properties is a topic of particular interest due to changes in the properties of solids with a decrease in the size of crystallites. However, this field has not been well studied due to high complexity of nanosized, strongly nonstoichiometric compounds production. Basically they are superhard cubic carbides and nitrides of transition metals. In this work niobium carbide NbCy with y = 0.77 was investigated. It is an extremely hard material, commercially used in tool bits for cutting tools.
To produce NbC powders in nanocrystalline state high-energy ball milling was used as it is a simple and effective method. Initial coarse-grained powder was grinded in a planetary ball mill for 5, 10 and 15 hours.
Main method for studying structure and microstructure of metals in terms of particle size and microstrains is the diffraction of short-wavelenght X ray or neutron radiation. In this work High Resolution Fourier Diffractometer (HRFD, IBR 2, JINR, Dubna) was used as an instrument for obtaining experimental data.
The analysis of the neutron diffraction data revealed the presence of two fractions with different particle sizes. It was shown that microstrains in nanosized powders are strongly anisotropic.

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Track Classification: Condensed Matter Physics