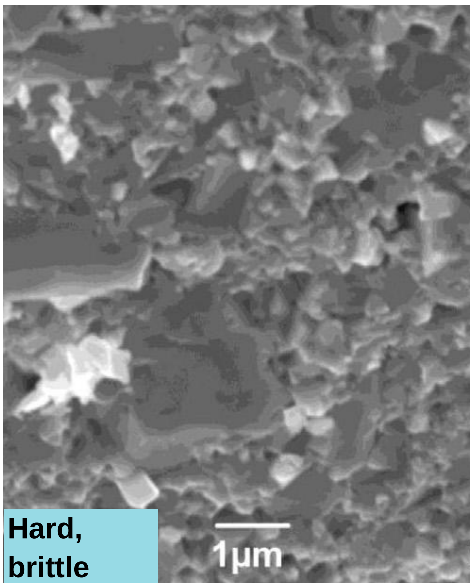
Research (What is it about?)	**Spark plasma sintering of tungsten carbide nanopowders**
UNN authors	*Chuvil'deev V., Nokhrin A., Boldin M., Sakharov N., Lantsev E., Blagoveshchenskiy Yu., Popov A.*
We find (The result)	Samples of high-density ***nanostructured*** tungsten carbide characterized by high hardness (up to 31-34 GPa) and improved ***fracture toughness*** (4.3-5.2 MPa $m^{1/2}$) were obtained using the Spark Plasma Sintering technology
Abstract	Pure tungsten carbide is of interest for a variety of applications (cutting tools, drawing dies, etc.) due to a good combination of physical and mechanical properties (high melting temperature, high hardness, low friction coefficient, and chemical resistance to corrosion and oxidation). However, due to high brittleness of tungsten carbide traditionally obtained with the help of a powder sintering technology, it cannot be used in its purest form. Cobalt or any other binding substance added during sintering help to reduce its brittleness, but at the same time the binding phase is considered a weak point in terms of corrosion and strength properties of the material. That is why the issue of achieving high mechanical properties with pure tungsten carbide is crucial. Tungsten carbide nanopowders and ultrafine powders are used as a starting material. Improving the mechanical properties of tungsten carbide is primarily associated with obtaining ultrafine grains in the sintered material. DC arc thermal plasma synthesis is the most advanced method of production tungsten carbide nanopowders. However, samples sintered from nanopowders have relatively high porosity and poor mechanical properties comparable with the properties of the material sintered from micron powders. We have developed the Spark Plasma Sintering (SPS) technology to obtain materials with ***high-density nano- and ultrafine grain structure***. Samples of high-density nanostructured tungsten carbide characterized by high hardness (up to 31-34 GPa) and improved fracture toughness (4.3-5.2 MPa $m^{1/2}$) were obtained.

Representative articles 2017-2018, quartiles	1. *Chuvil'deev V.N., Blagoveshchenskiy Yu.V., Nokhrin A.V., Boldin M.S., Sakharov N.V., Isaeva N.V., Shotin S.V., Belkin O.A., Popov A.A., Smirnova E.S., Lantsev E.A.* Spark plasma sintering of tungsten carbide nanopowders obtained through DC arc plasma synthesis. J. Alloys and Compounds. **708**, 547-561 (2017).	Q1, Q1, Q2
	Q-index (Qi) for the result	**3.67**

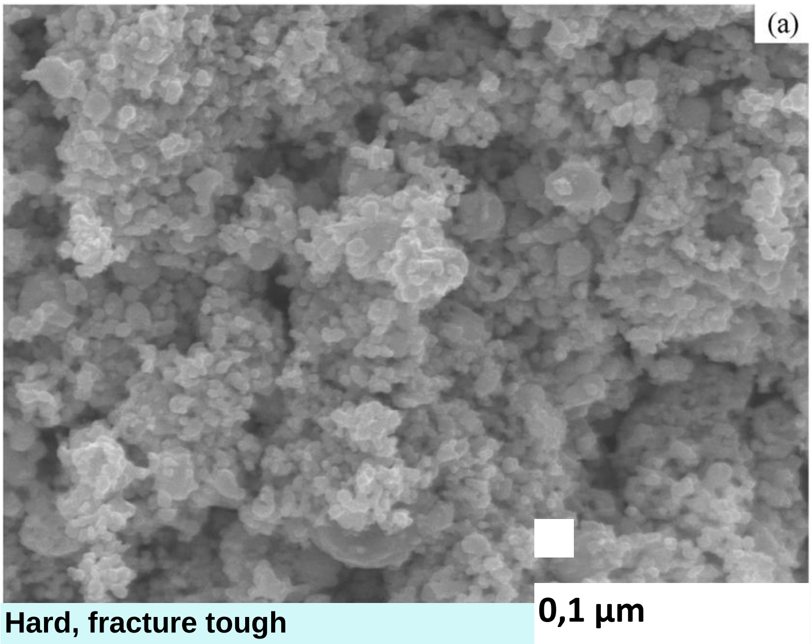
high blue

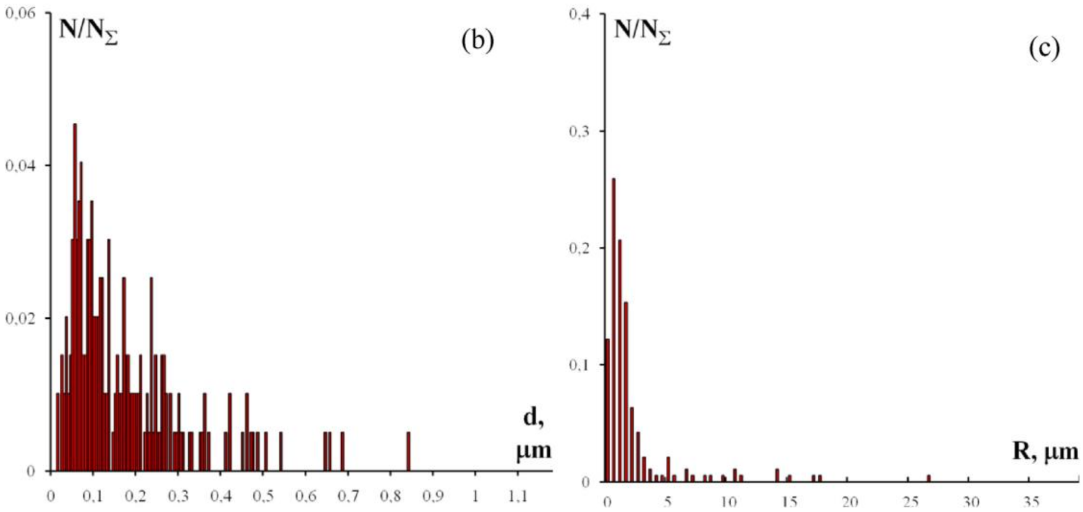
In collaboration	–



Abnormal grain growth in tungsten carbide…

and the microphotographs of tungsten carbide nanopowder obtained using SPS. Scanning electron microscopy.





Particle size distribution histogram (b) and conglomerate size distribution histogram (c) of tungsten carbide nanopowder. N – number of particles (conglomerates) of R size, N_Σ - total number of scaled particles (conglomerates).