

**The  
78th**

# **GRC INTERNATIONAL FRONTIER SEMINAR**

## **Ultrahard nanomaterials – myths and reality**

**Prof. Vadim Brazhkin (Institute for High Pressure Physics RAS)**

**Date : 13.May.2019 (Mon.) 9:30 – 10:30**

**Venue : Meeting Room #486, Science Research Bldg1, Ehime Univ.**

A critical analysis of the publications of the last 25 years on the production of carbon materials with a bulk modulus and hardness, much higher than the corresponding values for diamond, has been carried out. Three groups of myths that have emerged in recent years are analyzed: on the possibility of creating materials with bulk modules that are significantly higher than diamond ones; about the “experimentally measured” values of hardness, much higher than diamond; and about the supposedly “theoretical” grounds for increasing the hardness of covalent substances by several times (!) due to the effects of quantum confinement. It is shown that it is impossible in principle to produce materials with elastic modules that are significantly higher than diamond ones. The problems of quantitative measurement of hardness are discussed, it is noted that the creation of obstacles to the movement of dislocations in nanomaterials may allow an increase in the effective measured hardness of superhard materials by 20–40%. It is noted that other hypothetical ways to increase hardness, for example, due to quantum confinement, in fact, have no any physical grounds. The highest mechanical characteristics of diamond are associated with reliably established physical laws, and any statements about the possibility of obtaining materials with elastic characteristics or hardness several times greater than the values for diamond cannot be regarded as reliable.

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