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Pressure-temperature-induced transformations of hydrocarbon-fluorocarbon mixtures into nano- and micron-size diamonds

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Studies of thermal transformations of naphthalene, octafluoronaphthalene and their binary mixtures under pressure of 8 GPa have been undertaken as models for gaining understanding of processes of carbonization, graphitization and diamond formation in pure hydrocarbon, fluorocarbon and carbon-hydrogen-fluorine-containing systems under high pressures. The studies found a significant reduction in the initiation temperature thresholds for all major thermal transformation processes in case of binary mixtures with respect to thresholds for pure naphthalene and fluoronaphthalene. The naphthalene-octafluoronaphthalene mixture was selected as an example for investigation of the nature of large scale formation of micro (5-20 μm) and nanosize (10-20 nm) fractions of diamond in the transformations of binary mixtures of hydrocarbon and fluorocarbon compounds under high pressures. The origin of nanodiamond was found due to the specifics of carbonization of fluorocarbon compounds under pressure, which at 800-1000°C produces, along with submicron particles of graphite-like material, a significant amount of closed shell 2-5 layer carbon nanoparticles of 5-15 nm size. These carbon nanoparticles act as precursors for formation of nano size diamond fractions in the transformations of binary mixtures of hydrocarbon and fluorocarbon compounds. These results potentially open a new direction for metal catalyst-free synthesis of nano/micro-size fractions of pure and doped diamonds for broad areas of applications.

Biography

V N Khabashesku has earned his Doctor of Science degree and Doctoral CSc degree from the Zelinsky Institute of Organic Chemistry of the Russian Academy of Sciences in Moscow, Russia. He has done his MSc degree in Chemistry from Lomonosov Moscow State University. He has been a Faculty Member in Chemistry department at Rice University and the Department of Chemical and Biomolecular Engineering at the University of Houston. At present, he is a Senior Manager of Nanotechnology Center of Excellence at Baker Hughes Inc., one of the world-leading oil field services companies, and is also appointed as an Adjunct Professor in the Department of Materials Science and Nanoengineering at Rice University. He has authored more than 300 publications and has been serving as an Editorial Board Member of the *Journals of Nanotechnology and Materials.*

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