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Predictive analysis of nano-material attributes

Alex V Vasenkov
CFD Research Corporation, USA

Conventionally nanomaterials are defined as those of 1 to 100 nm size. Because of their tiny size and large surface to volume ratio, there is a significant concern that nanomaterials may be responsible for significant human health and environmental risks. It was recently recognized that traditional risk assessment procedures are inadequate for predicting the risks associated with the release of nanomaterials. The root of the problem is in an inadequate application of solid phase chemical principles (e.g., particle size, shape, and functionality) to the risk assessment of nanomaterials. Specifically, the "solubility" paradigm used to evaluate the risks associated with conventional contaminants must be replaced by a "dispersivity" paradigm. Technical challenges for the prediction of environmental risks of engineered nanomaterials include: (a) a lack of accepted measurement techniques and endpoints, (b) limited integration or use of data from published literature for predicting attributes of new materials, and (c) a lack of models to predict attributes. Those deficiencies were addressed in the proposed work by developing wiki style information system. Capability of this system for controlling access and ability for users to access data will be discussed.

Biography

Alex V Vasenkov is Senior Principal Scientist at CFD Research Corporation. He received his Ph.D. degree in thermophysics and molecular physics from the Russian Academy of Science in 1996. With 15 years of experience, he is an expert in material design, self-assembly processing of nanomaterials, and multi-scale modeling. Dr. Vasenkov is a prime developer of Multi-Scale Computational Framework. His research was funded by federal agencies (NSF, DOE, and DoD) and industry (Samsung Advanced Institute of Technology, etc.). He is the co-author of a book chapter on multi-scale modeling of materials and over 30 publications in peer-reviewed journals.

avv@cfdrc.com

Heat and noise in graphene: Unique properties and practical applications

Alexander A. Balandin
Department of Electrical Engineering and Materials Science and Engineering Program, University of California - Riverside, USA

Unique electronic properties of two-dimensional (2D) graphene originate from its unusual linear Dirac-cone dispersion. Phonons - quanta of lattice vibrations - in 2D crystals also reveal features different from those in bulk materials. In 2008, we discovered that the phonon thermal conductivity of suspended graphene can be exceptionally high - above ~2000 W/mK at room temperature - exceeding that of the basal graphite planes.We explained it by quenching of the Umklapp processes in 2D systems and resulting anomalously long mean free path (MFP) of the low-frequency acoustic phonons in graphene [2-4]. In the first half of my talk, I will review the results of our optothermal Raman measurements, and describe practical applications of graphene in thermal management of electronics, e.g. graphene heat spreaders for GaN technologies [5] and graphene fillers in the next generation of the thermal interface materials (TIMs) [6]. In the second part of my talk, I will discuss graphene electronic applications that do not require an energy band-gap including graphene-on-diamond interconnects with exceptional current-carrying capacity [7], low-noise graphene transistors for analog electronics and communications [8], phase detectors [9] and *selective* gas sensors implemented with pristine graphene [10].

Biography

Alexander A. Balandin received his BS (1989) and MS (1991) degrees Summa Cum Laude in Applied Physics and Mathematics from the Moscow Institute of Physics & Technology (MIPT), Russia. He received his MS (1995) and Ph.D. (1997) degrees in Electrical Engineering from the University of Notre Dame, USA. From 1997 till 1999, he worked as a Research Engineer at UCLA. In 1999 he joined the Department of Electrical Engineering at UC Riverside, where he is a Professor and Director of the Nano-Device Laboratory (NDL), which he organized in 2000. In 2005, during his sabbatical, he was Visiting Professor at the University of Cambridge, U.K. Prof. Balandin is a Founding Chair of the Materials Science & Engineering (MS&E) program at UCR. His research interests are in the area of advanced materials, nanostructures and devices for electronics, optoelectronics and energy conversion. He conducts both experimental and theoretical research. He is known for contributions to the phonon engineering and graphene fields, exciton and phonon confinement effects, 1/f noise in electronic devices, physics and applications of quantum dots. Prof. Balandin is a recipient of IEEE Pioneer of Nanotechnology Award for 2011. He was recognized by the ONR Young Investigator Award, NSF CAREER Award, UC Regents Award, and Merrill Lynch Innovation Award. He is an elected Fellow of several professional societies, including APS, OSA, SPIE, IOP and AAAS. He published ~185 journal papers, edited or authored 5 books and five-volume Handbook of Semiconductor Nanostructures and Nanodevices. His h-index is above 50 and his papers were cited over 10,500 times. He has given ~80 plenary, keynote and invited talks at conferences and government organizations. Prof. Balandin serves as an Editor of IEEE Transactions on Nanotechnology. His research has been supported by NSF, ONR, AFOSR, ARO, NASA, DOE, SRC, DARPA, CRDF, UC MICRO, IBM, TRW, Intel and Raytheon at the level of ~$1M per year for the last 10 years. More info about his research can be found at http://ndl.ee.ucr.edu.

balandin@ee.ucr.edu