JOINT EVENT

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&

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Keynote Forum

Day 1

Gerd Kaupp, Nano Res Appl 2018, Volume 4
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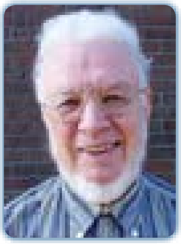

Gerd Kaupp

University of Oldenburg, Germany

Basic physics disproves the obligatory ISO-14577 standards: A dilemma for all indentation mechanics

Most mechanical properties of materials are deduced from indentation with pyramidal/conical diamond tips. The obligatory ISO-14577 standard iterates hardness (H_{ISO}) and elastic modulus (E_{r-ISO}) with triple violation of basic physics (energy law violation, wrong exponent on h, and denying phase transitions under load). Very high-load indentation techniques (Vickers, Knoop, Brinell, Rockwell, etc. hardness) are even more empiric and include the same violations. Thus, the normal force (F_N) is not proportional with h^2, but with $h^{3/2}$, as is physically founded[4] and experimentally confirmed. The wrong exponent 2 also prevents the detection of initial surface effects (that must be corrected for) and phase transitions under load. While the latter often occur within the 1000 µN range, some require the mN and up to >25 N range, where multiple phase transitions generally occur with the additional risk of macroscopic cracking (for example NaCl at 0.618 mN, 3.34 mN, 2.49 N, 9.12 N, 24.43 N, these without cracking[13]. The way for a physical treatment of indentations has been paved with "Kaupp-plots" ($F_N = k\,h^{3/2}$) since 1990. The material's penetration resistance k requires the energy-law correction factor of 0.8. But that is still not appreciated by the establishment. And pressure-formation requires work! Pressure has long been used for elastic modulus determinations though. It does not help that the very high-force techniques rely on the diameters of the impression surface such as Vickers, Knoop, Brinell (they are convertible into the depths), or that Rockwell and Shore measure the depth. Problems with cracks are not seen and reported (this does not mean cracks upon unloading for fracture toughness), but different load ranges have to be distinguished and empirical inter-conversion formulas are used. The physically valid H_{phys}=0.8k/tg^2 can now be obtained by linear regression of the loading curve's Kaupp-plot, excluding the three flaws. Indentation moduli E_{r-phys} require energy correction and experimental stiffness dF_{max}/d_h, using simplest arithmetic. Indentation moduli are not the claimed "Young's moduli" and should be directly calculated but not iterated with up to 11 free parameters. All of that is valid for all types of materials and instrumented depth sensing techniques. The dilemma of the ISO standards against physics and thus the woldwide "enforced" iteration of further wrong mechanical properties is detrimental, producing very large size-dependend errors and increasing crack probabilities. Liability problems for disastrous material failures ensue. Textbooks and instrument software must be rewritten, the ISO-14577, a NIST tutorial, and the opposing publications retracted. The physical correctness must be installed for the sake of daily life security. Examples will be discussed. ISO appears slow in changing its standards for complying with physics. I continuously ask them to release an urgent caveat, telling that ISO-14577 will be subject to change for the physical reasons.

Recent Publications

1. Kaupp G, (2013) Penetration resistance: a new approach to the energetics of indentations. Scanning 35: 392-401.
2. Kaupp G (2013) Penetration Resistance and Penetrability in Pyramidal (Nano)Indentations. Scanning 35: 88-111

3. Kaupp G (2014) Activation energy of the low-load NaCl transition from nanoindentation loading curves. Scanning 36: 582-589.
4. Kaupp G (2016) The physical foundation of FN = kh3/2 for conical/pyramidal indentation loading curves. Scanning 38: 177- 179 (open access)
5. Kaupp G (2006) Dilemma zwischen ISO und Physik: Nanotechnologie decktauf. Nanobay, 3. May 2016.

Biography

Gerd Kaupp studied chemistry at the University of Würzburg, Germany, and was appointed full professorship at the University of Oldenburg in 1982. Since 2005 he is retired member at the University of Oldenburg. He served as guest professor and pursues his scientific interests also with consulting. His expertise is in chemical kinetics, laser photochemistry, waste-free benign productions, solid-state chemistry, reactive milling, mechanochemistry, atomic force microscopy, scanning near-field optical microscopy SNOM, nanoscratching, nanoindentation, bionics, and standardization of nanomechanics. He is keynote speaker in these fields, published numerous scientific papers and books and is inventor of patents in solid-state and environmental chemistry.

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Notes:

Omar S Es-Said, Nano Res Appl 2018, Volume 4
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Omar S Es-Said

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Can Charpy impact testing (high strain rate) detect the presence of hydrogen in high strength steels?

Hydrogen was intentionally introduced into ultra-high strength steel by cadmium plating. The purpose was to examine the effect of cadmium plate thickness, and hence, hydrogen on the impact strength of the steel. The AISI 4340 steel was austenitized at 1000°C for 1 hour, water quenched, and tempered at temperatures between 494 and 1100°C in order to achieve a range of targeted strength levels. The specimens were cadmium plated with 0.00508 mm (0.2 mils), 0.00762 mm (0.3 mils), and 0.0127 mm (0.5 mils). Results demonstrated that the uncharged specimens exhibited higher impact energy values when compared to the plated specimens at all tempering temperatures. The results of this work are best explained by the dislocation transport (sweeping) of hydrogen model.

Recent Publications

1. Z Zupin and K Dimitrovski (2010) Mechanical properties of fabrics from cotton and biodegradable yarns, bamboo, SPF, PLA in weft. Woven Fabric Engineering 25-46.
2. S Es-Said, J Foyos, R Noorani, M Mendelson and B Pregger (2000) Effect of layer orientation of mechanical properties of rapid prototyped samples. Journal of Materials and Manufacturing Processes 15(1):107-122.
3. V Vega, Clements J, Lam T, Abad A, Fritz N, Ula N and O S Es-Said (2011) The effect of layer orientation on the mechanical properties and microstructure of a polymer. Journal of Material Engineering and Performance 20(6):978-988.
4. Montgomery, Douglas C and George Runger (1994) Probability and Statistics for Engineers. N.p.: Wiley 74.

Biography

Omar S Es-Said is a Professor in Mechanical Engineering Department at Loyola Marymount University in Los Angeles, California. He was an Assistant Professor from 1985-1992, Associate Professor from 1992-1998, and Full Professor from 1998-present at Loyola Marymount University in Los Angeles, California. He has completed his BS in Physics and MS in Solid State Physics at The American University in Cairo. He has completed his PhD in Metallurgical Engineering and Materials Science at the University of Kentucky, Lexington in 1985. His current research interests include "Metallic processing, modeling, experimental, techniques, and failure analysis". He has published over 300 papers, which included refereed journal articles, conference proceedings, industrial reports, and Department of Defense (DoD) reports. He has been an Associate Editor from 2008-present for the American Society of Materials (ASM), Journal of Materials Engineering and Performance (JMEP). He has been the Editorial Board Member of the Engineering Failure Analysis Journal from 2003-present. He has received several awards. He was a Consultant for the Navy from 1994-present. He was hired as a Distinguished Summer Faculty Fellow at The Navy Facilities Engineering Services Center (NFESC) in the summers of 2010-2017. He became an American Society of Materials (ASM) Fellow in 2005.

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Notes:

Masaru Matsuo, Nano Res Appl 2018, Volume 4
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Mechanical and electric properties of nanofiber - polymer composites under different electric fields

Under external vibration, the damage of polymer-filler composites by Joule heat associated with tunneling current is thought to be serious than that by hot air. To elucidate it, the storage modulus for polyethylene (PE)-nickel coated carbon fiber (NiCF) composites and that for aromatic polyimide (PI)-vapor grown carbon fiber (VGCF) composites were measured as a function of frequency by the two heating methods. In common, the storage modulus of PE-NiCF decreased with increasing temperature and this tendency was considerable with decreasing frequency. However, the relative decrease of the modulus by Joule heat was more remarkable than that by hot air. This was due to the fact that the sample damage by Joule heat is associated with an increase in electron transfer in PE matrix at elevated temperature. Probably, it was postulated that electron transfer by tunneling effect between NiCFs caused partial discharge on PE surface and allowed appearance of pits and electron treeing, and finally the growth of the treeing wreaked electron breakdown. Such sample damage indicated that the electric field must be controlled to use as PTC materials like floor heating in winter season. In comparison with PE-NiCF, frequency dependence of the storage modulus for the PI-VGCF composite was not considerable against elevated temperature by Joule heat because of high heat resistance of rigid PI chains. Actually, the distance between adjacent VGCFs was independence of electric field because of no thermal expansion of PI. The phenomenon was analyzed in terms of theoretical calculation for thermal fluctuation-induced tunneling effect. The approach indicated that the increase in current is attributed to an increase in electron transfer area on VGCF surface and is independent of the distance between adjacent VGCFs.

Biography

Masaru Matsuo has completed his PhD at Kyoto University in Japan and he was a professor of Nara Women's University. After his retirement, he became a full time professor of Dalian University of Technology in China. Since September 1st 2014, he is a visiting professor of Dalian University of Technology. He has published more than 200 papers in refereed journal articles. He is IUPAC fellow and "Certificate of Membership Award of ACS (July 2015~ July 2018). He received "Award of Society of Fiber Science and Technology of Japan on May 1990, "Paul Flory Polymer Research Prize" on April 2010 and "Certificate of friendship Award of Liaoning Province in China" on September 2011.

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Notes:

Mineo Hiramatsu, Nano Res Appl 2018, Volume 4
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Plasma processing for carbon nanostructures

Carbon nanostructures, namely, graphene-based materials such as carbon nanotube and graphene itself have attracted much attention due to their outstanding properties as well as emerging applications. For the synthesis of diamond and amorphous carbon films, graphene-based materials can be synthesized by several plasma enhanced chemical vapor deposition (PECVD) techniques on heated substrates (600-800˚C) employing methane and hydrogen mixtures. For example, plane graphene formation can be realized by PECVD on Ni substrate in the remote plasma configuration at relatively low temperatures (~650˚C). In fact, excess flux of carbon precursors causes supersaturation and ion bombardment induces the nucleation of nanographene, resulting in the formation of vertical nanographene (carbon nanowall, CNW). CNWs are few-layer graphenes standing vertically on a substrate to form a self-supported network of wall structures. The maze-like architecture of CNWs with large-surface-area graphene planes would be useful as electrodes for energy devices, electrochemical and biosensors. Morphology including structure and crystallinity as well as electrical properties of carbon nanostructures should be controlled according to their applications. Plasma processing has a significant role in fabricating carbon-based materials and achieving their practical use in many areas. We report the current status of the synthesis of plane graphene and vertical graphene using PECVD, and focus on the control of the CNW structures during the growth processes as well as post treatment to be used as platform of the electrochemical and bio applications.

Biography

Mineo Hiramatsu is a full professor in Department of Electrical and Electronic Engineering and the Director of Research Institute, Meijo University, Japan. He served as the Director of The Japan Society of Applied Physics. His main fields of research are plasma diagnostics and plasma processing for the synthesis of thin films and nanostructured materials. He is an Author of more than 100 scientific papers and Member of organizing and scientific committees of international conferences on plasma chemistry and plasma processing. He is the Fellow of Japan Society of Applied Physics.

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Guskov Aleksandr, Nano Res Appl 2018, Volume 4
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Guskov Aleksandr

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The formation of periodic concentration distribution under the phase transition of solutions

The purpose of this study is to explain how the periodic alternation of phases is formed in a homogeneous liquid solution during phase transition liquid-solid. The formation of a periodic structure is explained for two cases; first, for the case where the periodic distribution of the components occur in the liquid phase and second, the formation of periodic eutectic structure. This study shows that a solution during crystallization can be in unstable state. The unstable condition leads to decomposition the solution by spinodal scenario. Experimental demonstration of spinodal decomposition of the solution is conducted by video shooting process of decomposition of an aqueous solution of bromothymol blue while its crystallization. Periodic distribution bromothymol blue is the result of these experiments. Locally configuration thermodynamic model is used to explain the state changes of the solution during the phase transition. Spinodal decomposition of the solution explains the process of formation of a periodic distribution of the eutectic composites. The layer of the unstable solution is localized in front of the unstable interface. The unstable solution decomposes into phases, which have a composition close to the eutectic composition of the solid phases. The period of alternation of these phases is set by the period of instability of the interface. Experiments show that the formation of dendrites in the mushy zone and extremum of the component concentration during steady-state regime of crystallization close to interface also occurs in the spinodal decomposition scenario.

Recent Publications

1. A Guskov and L Nekrasova (2013) Decomposition of solutions in front of the interface induced by directional crystallization. Journal of Crystallization Process and Technology 3:170-174.
2. Guskov A P, Nekrasova L P, Ershov A E and Kogtenkova O A (2013) The decomposition of the solution in the interface under directional solidification. Materials Science, 10:10-15.
3. Guskov A () Spinodal decomposition of solution during crystallization. Diffusion Fundamentals 30:1-9.
4. Guskov A P (2016) The decomposition of the solution during the formation of eutectic composites. COMPOSITES and NANOSTRUCTURES, 8 (3): 2-15.
5. Alex Guskov (2014) On linear analysis of the movement of the interface under directed crystallization. Advances in Chemical Engineering and Science 4:103-119.

Biography

Guskov Aleksandr has completed his PhD at Physical Institute of the Russian Academy of Sciences in 1982. Then he went to work at the Institute of Solid State Physics the Russian Academy of Sciences, investigated the influence of interaction of laser radiation and a solid. Simultaneously, he was engaged in application of technological processes in manufacture of electronic devices. Now his research interest focuses on Heat Mass Transfer during the phase transition.

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Haruo Sugi, Nano Res Appl 2018, Volume 4
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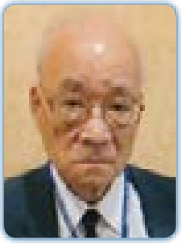

Haruo Sugi

Teikyo University School of Medicine, Japan

Myosin heads in muscle can sense presence or absence of actin filaments to decide the direction of ATP-induced movement

Although almost 70 years have passed since the monumental discovery of Huxley and Hanson; that muscle contraction results from relative sliding between actin and myosin filaments, which in turn caused by cyclic attachment and detachment between myosin heads extending from myosin filaments and the corresponding myosin binding sites in actin filaments. The performance of myosin heads still remains to be a matter for debate and speculation. The main reason why the research work on the myosin head performance is retarded is asynchronous nature of myosin head movement; experimental methods including muscle mechanics, chemical probes and time resolved X-ray diffraction can detect only averaged myosin head movement with ambiguous results. To visualize and record myosin head movement coupled with ATP hydrolysis, we developed the gas environmental chamber (EC), which enabled us to record ATP induced power and recovery strokes in individual myosin heads in hydrated, living myosin filaments in the presence or absence of actin filaments. Our results obtained from experiments using the EC have revealed the fundamental properties of myosin heads in muscle, which can be summarized as follows: In the absence of actin filaments, myosin heads fluctuate around the definite neutral position; on binding with applied ATP, myosin heads take the form of M-ADP-Pi (charged-up state) to perform recovery stroke in the direction opposite to power stroke; after exhaustion of ATP, myosin heads return to the neutral position; in the presence of actin filaments, myosin heads bind with applied ATP to take the form of M-ADP-Pi (charged-up state) to perform power stroke while attached to actin filaments; after exhaustion of ATP, myosin heads return to the neutral position. These results show that myosin heads can sense presence or absence of actin filaments and decide the direction of ATP induced movement without being guided by actin filaments.

Biography

Haruo Sugi completed his postgraduate from the University of Tokyo and worked at the University of Tokyo Medical School, Columbia University and the National Institutes of Health. He was Professor and Chairman in the Department of Physiology, Teikyo University Medical School from 1973 to 2004 when he became Emeritus Professor. He was chairman of Muscle Commission in the International Union of Physiological Sciences from 1996 to 2006.

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A D Levin, Nano Res Appl 2018, Volume 4
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A D Levin

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Optical nanosensor based on light scattering: Physical principles and applications for medical diagnostics and food control

Optical sensors based on size and shape change the functionalized nanoparticles (NP) due to interaction with the analyte are considered. NP's are functionalized by antibodies and in the case of presence of the specific analyte in the solution aggregation or shell formation process occurs. The change in particle size caused by these processes is controlled using dynamic light scattering (DLS) or resonance light scattering (RLS) spectroscopy. Both optical methods are available and non-invasive. Such techniques have several advantages in comparison with the conventional immune-chemical analysis–they are washing-free and time-saving. For medical applications nanoparticles sizing in blood plasma is required, for this purpose depolarized light scattering helps to distinguish light scattering of conjugates from the scattering of plasma proteins. The model describing the kinetics of functionalized NP size increasing was developed and applied for the optimization of nanosensor parameters (material, size, shape and concentration of NP). Experimental results on DLS based nanosensor for the disease markers and food contaminants are presented. New DLS instrument and data processing algorithms developed for applications with optical nanosensor gives the additional opportunities–non-spherical NP sizing using multi-polarization DLS, estimation of NP number concentration and, subtraction of the background NP size distribution.

Biography

Alexander Levin is Leading Research Scientist of the All-Russian Research Institute for Optical and Physical Measurements. He received PhD in Experimental Physics in 1981, he worked in various scientific and managerial positions in the field of laser methods of diagnostic, physical optics, developing of analytical spectral instruments for atomic and molecular spectroscopy, photon correlation spectroscopy. Since 2007 he is Doctor of Engineering Science, head of the scientific group, developing optical methods and instruments for nanoparticles characterization. Dr. Levin currently manages the projects on optical nanosensors and development of reference materials for fluorescence. He is the author and coauthor of the 3 monographs, over 80 scientific publications and 10 inventions. He has given many lectures at various national and international scientific conferences.

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Yongyi Zhang, Nano Res Appl 2018, Volume 4
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Yongyi Zhang

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Carbon nanotube and graphene fibers: Synthesis, properties and functional applications

Due to the unique structures and supreme mechanical, electrical and thermal properties, carbon nanotube and graphene are ideal building blocks for super fibers which own great potential applications in many fields. However, the lack of effective assembles technique makes it is of great challenges in obtaining strong nanocarbon fibers with multifunctional properties and applications. Here we will talk about our concerned work on the synthesis, assembly and mechanical properties of carbon nanotube and graphene fibers, and their applications in fields such as EMI, energy will be included as well.

Biography

Yongyi Zhang received his BS degree in Chemistry from Beijing Normal University in 2002 in China and PhD in Physical Chemistry from Peking University in China in 2008. He worked as a Post Doc. in University of Michigan, Ann Arbor and University of South Dakota in USA from 2008 to 2011. Dr. Zhang has been appointed as an associate Professor since 2011 and became a Professor at the Advanced Material Department at Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences since 2017. He is also the director of the Nanomaterials Department at Suzhou Institute of Nano-Tech and Nano-Bionics, Nanchang, Chinese Academy of Sciences since 2017. His interests include the synthesis, assembly, properties and applications of carbon nanotube and graphene fibers. He has published over 40 papers and applied over 40 patents.

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Jerome Tignon, Nano Res Appl 2018, Volume 4
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Jerome Tignon[1, 2, 3]

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Terahertz (THz) short pulse generation in quantum cascade lasers

In the terahertz (THz) range, a semiconductor based technology for intense and ultrashort pulse generation has yet to be realized. Although THz quantum cascade lasers (QCLs) are a foundational semiconductor laser in the THz range, to date, the generation of stable and ultrashort pulses from QCLs has proven to be difficult. These devices, first realized in 2002, permit the frequency, and bandwidth to be entirely engineered. Active mode locking, where the device is electrically modulated at its' roundtrip, has been extensively applied but the pulses generated so far have been limited to the range of 10ps to 20ps, despite several years of research effort. Although THz QCLs with extremely large gain bandwidths have been realized leading to impressive developments in frequency comb generation, this has not translated directly into the formation of stable ultra-short pulses in the THz range. Here, we resolve the THz QCL short pulse bottleneck through an on-chip geometry that permits the GDD of the QCL to be compensated, leading to considerably shorter pulses when the QCL is active mode locked. This is realized through the monolithic integration of a small resonator at one end of a 2.5 THz QCL cavity, based on a Gires-Tournois Interferometer (GTI) approach that adds an opposite dispersion to that of the material. This directly results in pulse durations as shorts as 4 ps, from 16 ps with a standard QCL geometry.

Biography

Jerome Tignon has completed his PhD at École Normale Supérieure (ENS/SU) in Paris in 1996 and his Postdoctoral studies at Lawrence Berkeley National Lab (LBNL Berkeley, CA) in the Chemla group (1996-98). He is currently the Director of the Laboratoire Pierre Aigrain in the Physics Department of Ecole Normale Superieure in Paris. He has published more than 150 papers, given over 50 invited talks and will be the chairman of IRMMW-THz in Paris (2019).

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Notes:

JOINT EVENT

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Day 2

Myung Chul Chang, Nano Res Appl 2018, Volume 4
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Myung Chul Chang

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Preparation and fabrication studies of three dimensionally ordered nano - micro and meso-scale calcium phosphate crystallites scaffold for artificial bone materials (3-DOMm)

Preparation and fabrication studies of three dimensionally ordered nano-, micro- and meso-scale calcium phosphate crystallites scaffold for artificial bone materials (3-DOMm): In clinical surgeon for humane bone replacement the artificial bone materials have been developed on a basis of biomechanical capability and nontoxic ability. Since 1987 the calcium phoaphte bone materials have been developed, showing proper mechanical strength, bioability and bone regeneration in bone metabolism. From several years ago global companies such as Stryker, ETEX and Biomet-Merck have commercially introduced the calcium phosphate bone products. The structure of humane bone is known to be the nanocomposites between collagen and hydroxyapatite. Biomimetic bone science have studied for the clinically possible surgical application of calcium phosphate bone. The primary study was how to mimic porous bone scaffold in calcium phosphate/collagen matrix. The second issue was how to attain the mechanical property of real humane bone. In first generation of artificial bone development acrylic polymer such as PMMA was mostly used because of the good mechanical strength in spite of serious toxic problem during surgery. Since calcium phosphate cement [CPC] bone has been introduced as bone regeneration, there was a big problem in clinical application because of low mechanical strength. Polymer modification study into CPC cement has been tried. We have focused on the development of pure calcium phosphate products having proper mechanical strength similar to real humane bone. The bioregeneration ability was shown and new syringe design was introduced for the clinical surgeon. We have been keeping the study of calcium phosphate science and engineering technology in bone metabolic condition. All of phosphate research are based on monodispersed control of nano-, micro-, and meso-scale for the bone scaffold application.

Biography

Myung Chul Chang has completed his PhD at Seoul National University and Postdoctoral studies at University Illinois at Urbana Champaign. He is the Director of Biomaterials Lab. He has published more than 50 papers in reputed journals and has been serving as an Editorial Board Member of reputed journals.

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Mahmoud Helmi Attia, Nano Res Appl 2018, Volume 4
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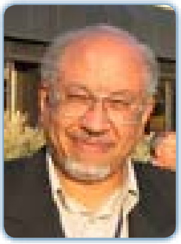

Mahmoud Helmi Attia[1, 2]

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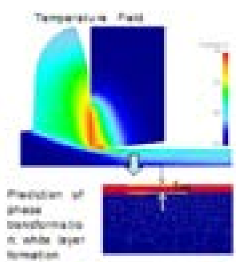
Status and future directions of adaptive, smart and sustainable machining systems for aerospace applications

Manufacturing remains the largest and most important wealth generating sector. Within this sector, material removal is a key technology in the aerospace and automotive industries, contributing to more than $200 billion to the economy in North America on annual basis. The demand for high productivity and high accuracy is steadily increasing, along with the increasing attention to the impact on the environment. In this work, only conventional machining processes are discussed, although a number of nonconventional processes are in demand in the aerospace industry. A system approach to the machining system is presented in terms of its elements (machine, tool, work piece and fixture), properties (materials, configuration, contact interfaces) and interactions (dynamic, tribological, thermal, thermo-elastic) to set the framework for predicting the system response (quality attributes and machining-induced defects) to the operational input (controlled cutting conditions and uncontrolled dynamic-tribo-thermo-elastic self-induced changes). The paper provides a critical assessment of the current status of smart and sustainable material removal technologies, and the research effort towards the development of new and hybrid machining strategies and processes for: (a) high speed/high performance machining, sustainable manufacturing and tool life management, (b) machining of composites, stacked materials, (c) high performance/ super abrasive advanced grinding and polishing, (d) physics-based modeling and simulation of the machining system to achieve a virtual machining environment for the realization of the first part correct philosophy, and (e) adaptive machining, where model-based control systems of the part-machine tool interaction and process monitoring allow the industry achieve unmanned closed machining key enabling technologies have been identified to achieve these terminal objectives. This includes new processes for achieving micro-nano-sized microstructure components, and to deal with new materials. Other new trends include the integration of non-conventional technologies towards the development of new hybrid multifunctional machining processes.



Recent Publications

1. Hassan M, Sadek A, Damir A, Attia M H and Thomson V (2018) A novel approach for real-time prediction and prevention of tool chipping in intermittent turning machining. Annals of CIRP DOI: 10.1016/j.cirp.2018.04.065.
2. Jawahir I S, Attia M H, Biermann D, Duflou J, Klocke F, Meyer D, et al. (2016) Cryogenic manufacturing processes," Keynote Paper, CIRP Annals - Manufacturing Technology 65:713-736.
3. M'Saoubi R, Axinte D, Soo S L, Nobeld C, Attia M H, Kappmeyer G, Engin S and Simh W M (2015) High performance cutting of advanced aerospace alloys and composite materials, Keynote Paper, CIRP Annals - Manufacturing Technology, 64(2):557-580.
4. Hassan M, Sadek A, Attia M H and Thomson V (2017) A novel generalized approach for real-time tool condition monitoring. ASME Trans, J. Manufacturing Science and Engineering, 140(2):021010-021010-8.
5. Sultana I, Shi Z, Attia M H and Thomson V (2016) A new hybrid oscillatory orbital process for drilling of composites using super abrasive diamond tools. CIRP Annals- Manufacturing Technology, 65:141-144.

Biography

Mahmoud Helmi Attia is the Principal Research Officer, Manager of Advanced Material Removal Processes at the National Research Council Canada, and Adjunct Professor of Mechanical Engineering at McGill University. He is a Fellow of CIRP (College International pour la Recherche en Productique), Fellow of SME (Society of Manufacturing Engineers) and Fellow of ASME (American Society of Mechanical Engineers). He is the Recipient of 'Queen Elizabeth II Diamond Jubilee Medal' (2013) and the 'ASME Blackall Machine Tools and Gage Award' (1989). He is the Editorial Board Member of number of international journals. He has authored/co-authored 250 papers in archival journals and refereed conference proceedings.

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Notes:

Masahiko Kondow, Nano Res Appl 2018, Volume 4
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Masahiko Kondow

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Photonic crystal circular defect (CirD) laser

By the analogy of Inter-chips optical interconnections, the target density for Intra-chip optical interconnections is estimated to be 10 Pbps/cm^2. This value may not be possible by Si-photonics anymore, because its target density is 10 Tbps/cm^2. The authors have proposed a solution by using 2 dimensional photonic crystal (PC). The laser-cavity is a circular defect (CirD) in the PC lattice. Only a whispering galley mode (WGM) with 9 wavelengths can stably exist there. The light in the cavity is outputted through the line-defect waveguide which is optically coupled with the cavity. The lasing wavelength in each cavity can be varied by changing the radius of CirD cavity. When cavities with different lasing wavelengths are placed near an output waveguide, the wavelength division multiplexing (WDM) transmission system can be realized without a conventional optical multiplexer. Each laser can operate at a speed of 50 Gbps due to small cavity volume. Therefore, the WDM transmission system with 20 channels results in transmission capacity of 1 Tbps. Since footprint of the proposed light source is 100 μm square, the density of 10 Pbps/cm^2 can be realized.

Biography

Masahiko Kondow received the B.E and M.E degrees in electrical engineering, from Osaka University in 1984 and 1986, respectively. Since 1986, he had been with Central Research Laboratory, Hitachi, Ltd. He received the Ph.D. degree in electrical engineering from Osaka University in 1991. In 1998, he was with University of California, San Diego, as a visiting scholar. Since 2005, he has been with Osaka University as a professor in Graduate School of Engineering.

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Ze Xiang Shen, Nano Res Appl 2018, Volume 4
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Ze Xiang Shen

Nanyang Technological University, Singapore

Configuring 2D materials by stacking order for energy harvesting and homo-junctions

It is well established that the optical and electronic structures of two dimensional transition metal dichalcogenide (2D TMD) materials and perovskites often show very strong layer-dependent properties. It is less well-known that the properties can also be tuned by stacking order, which allows us to build electro and optical devices with the same material and the same thickness. Detailed understanding of the inter-layer interaction will help greatly in tailoring the properties of 2D TMD materials for applications, e.g. in p-n junction, transistors, solar cells and LEDs. Raman/photoluminescence (PL) spectroscopy and imaging have been extensively used in the study of nano-materials and nano-devices. They provide critical information for the characterization of the materials such as electronic structure, optical property, phonon structure, defects, doping and stacking sequence. In this presentation, we use Raman and PL techniques and electric measurements, as well as simulation to study 2- and 3-layer 2D TMD samples. The Raman and PL spectra also show clear correlation with layer-thickness and stacking sequence. Electrical experiments and *ab initio* calculations reveal that difference in the electronic structures mainly arises from competition between spin-orbit coupling and interlayer coupling in different structural configurations. 2D material homo-junctions using 2H and 3R stacking show clear p-n junction behavior which opens up unique potential applications for nano-electronics and solar cells.

Biography

Ze Xiang Shen is a Professor in the School of Physical and Mathematical Sciences at Nanyang Technological University (NTU); Co-director at the Centre for Disruptive Photonics Technologies. His main research areas include graphene, 2D materials and perovskites. He also works on graphene based composites for energy harvesting (Li Ion batteries and supercapacitors) and nano electronics. He has won the NTU Nanyang Award for Research and Innovation and Gold Medal for Research Excellence by Institute of Physics Singapore. He authored over 500 peer reviewed journal papers, six book chapters, edited five books and over 300 conference papers.

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Notes:

Xudong Zhao, Nano Res Appl 2018, Volume 4
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Xudong Zhao

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Key technologies for the novel solar driven heating and cooling systems

The paper addressed several key technologies that enable solar driven heating and cooling systems for buildings to operate in efficient and effective ways. In terms of the solar heating, the multiple-throughout-flowing featured panels-array in combination with micro-channel structure for individual panels are the most creative technologies that has proven to be able to achieve 10% higher solar thermal efficiency and 100% higher energy efficiency ratio compared to the existing solar thermal system. In addition, the coupled heat storage/exchanger with the double containers is able to speed up heating time and increase the heat transfer capacity of the system, and is regarded as an additional initiative. The cost balance approach is applied to determine the quantity and area of the PV panel, leading to a new way of achieving the zero-bill heating operation in an economic way. In terms of the solar cooling, the innovative super-performance dew point cooling involving advanced fiber materials, superior thermal-assisted pressing approach for bonding of the fiber material with dry side material, as well as intelligent control of the pump and fan is detailed. Furthermore, the solar driven adsorbent bed cyclic system using the solar radiation and solar based microwave energy was introduced.

Recent Publications

1. Peng Xu, Xiaoli Ma, Xudong Zhao and Kevin Fancey (2017) Experimental investigation of a super performance dew point air cooler. Applied Energy 203:761-777.
2. T M O Diallo, X Zhao, A Dugue, P Bonnamy, F J Miguel, A Martinez, T Theodosiou, J Liu and N Brown (2017) Numerical investigation of the energy performance of a ventilated façade system employing a smart modular heat recovery unit and a latent heat thermal energy system. Applied Energy 205:130-152.
3. Jinzhi Zhou, Xudong Zhao, Xiaoli Ma, Zhenyu Du, Yi Fan, Yuanda Chen and Xinghui Zhang (2017) Clear-days operational performance of a hybrid experimental space heating system employing the novel mini-channel solar thermal & PV/T panels and a heat pump. Solar Energy 155:464-477.
4. Wansheng Yang, Hao Deng, Zhangyuan Wang, Xudong Zhao and Song He (2017) Performance investigation of the novel solar-powered dehumidification window for residential buildings. Energies 10:1369.
5. Zhiyin Duan, Xudong Zhao and Junming Li (2017) Design, fabrication and performance evaluation of a compact regenerative evaporative cooler: Towards low energy cooling for buildings. Energy 140:506-519.

Biography

Xudong Zhao is the Director of Research and Professor in the School of Engineering and Computer Science at University of Hull, UK. He is a distinguished academia in the areas of sustainable building services, renewable energy and energy efficiency technologies, and mechanical engineering. Over more than 30 years of professional career, he has led or participated in 57 research projects funded by EU, EPSRC, Royal Society, Innovate-UK, Royal Academy of Engineering, China Ministry of Science and Technology and industry with accumulated fund value of approximately £18 million, 40 engineering consultancy projects worth £5 million, and claimed 11 patents.

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Single-walled carbon nanotube synthesis by alcohol catalytic chemical vapour deposition in high vacuum using platinum-group metal catalysts

For the realization of application of single-walled carbon nanotubes (SWCNTs) to electronics devices, control of chirality and reduction of growth temperature have been significant issues. At present, 3d transition metals, such as Fe, Co and Ni, are widely used as catalysts for SWCNT growth in chemical vapour deposition (CVD). However, due to Ostwald ripening, these catalysts are apt to aggregate at the growth temperature, resulting in enlargement of both diameter and chirality distribution of SWCNTs. We performed SWCNT growth by a gas source-type alcohol catalytic CVD system using platinum-group metal catalysts (Ru, Rh, Pd and Pt). By optimizing the ethanol gas supply using a CVD system in a high vacuum, SWCNTs were grown from these metals between 400 and 700°C. In particular, SWCNTs were grown from Rh catalysts even below 300°C. Irrespective of catalyst metals, the diameter and chirality distribution of grown SWCNTs became narrower, as the growth temperature decreased. The diameters of most SWCNTs grown from Pt catalysts were below 1 nm, having a narrow chirality distribution. We demonstrated that the platinum-group metal catalysts are effective for both low temperature growth and narrow chirality distribution. Based on the SWCNT diameter and catalyst particle size, we discuss the growth mechanism of SWCNTs from the platinum-group metal catalysts.

Biography

Takahiro Maruyama is a Professor in the Department of Applied Chemistry at Meijo University, Nagoya, Japan. He has completed his Graduation in Factory of Science at Kyoto University; PhD at Kyoto University and; Postdoctoral studies at University of Tsukuba and Ritsumeikan University. He is the Director of Nanomaterials Research Center at Meijo University. He has published more than 100 papers in peer-reviewed international journals and has been serving as an Editorial Board Member of *GCET.*

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Han-Yong Jeon

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Nanoclay application to geotextiles to improve adsorption function for removal of heavy metal and toxic components in waste landfill sites

Nanofibers are one of the most advanced materials which can be easily designed with high performance materials having distinctive properties. In addition to fibers, nanoparticles (such as nanoclay) can be used to make unique formulations which can, in turn, be used to make conventional fibers for geotextiles and yarn-type geogrids. As an example of nanocomposite geo-synthetics in geo-environmental applications, it is very important to eliminate the toxic and organic components of various waste leachate solutions. There is no such capability for the standard manufactured nonwoven geotextiles and needed is to manufacture the functional nonwoven geotextiles which can absorb the toxic and organic components that may be harmful to personal health and the environment. The general concept of nanotechnology formulations used to manufacture geotextiles is introduced in this paper. Separation and filtration functions using geotextiles from nanoclay formulations are introduced as an important concept. For an example of nanoclay formulations used to manufacture geotextiles, yellow clay as nanoparticles were added to make a polyester formulation in turn to make nonwoven geotextiles to improve the removal effects of toxic and organic components of leachate solutions. Engineering test behavior was evaluated to confirm the effects of yellow clay addition. Finally, the possibility of nanocomposite formulations for geo-synthetics is considered in a number of common situations.

Biography

Han-Yong Jeon is a Geosynthetics/Technical Organic Materials Researcher and he was the 32nd President of Korean Fiber Society (2014~2015). He has published more than 881 proceedings in domestic and international conferences. He wrote 20 texts including 'Geosynthetics' and also published 144 papers in domestic and international journals. He has won the awards of Marquis Who's Who-Science and Engineering in 2003~2018 and also, he got the 33rd Academy Award of Korean Fiber Society in 2006 and "Excellent Paper Award of 2012" by The Korean Federation of Science and Technology Societies.

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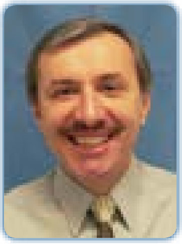

Andriy Kovalenko

University of Alberta, Canada

Multiscale modeling framework for nanoparticles, nanomaterials and nanotechnology

Molecular theory of solvation for nanostructures in both aqueous and non-aqueous solution, a.k.a. three-dimensional reference interaction site model (3D-RISM) with Kovalenko-Hirata (KH) closure relation, was systematically developed and applied to a variety of compounds, supramolecules and biomolecules in a number of solvents, mixtures, electrolyte and non-electrolyte solutions. From the first principles of statistical mechanics, 3D-RISM-KH theory predicts solvation structure and thermodynamics of nanochemical and biomolecular systems, including their analytical long-range asymptotics. It yields high accuracy, efficiency, and applicability by multiscale coupling of methods at different space and time scales to provide fundamental understanding and prediction for nanomaterials and biomolecules. The method has been coupled with quantum chemistry, molecular dynamics and dissipative particle dynamics. Examples include helical rosette nanotubes with tunable stability and hierarchy, water promoted supramolecular chirality inversion, formation and stability of self-assembling supramolecular structures of organic rosette nanotubes with ordered shells of inner and outer water, aromatic hydrocarbons in kaolinite solutions, and accurate and efficient dissipative particle dynamics of polymer chains with coarse-grained effective pair potential obtained from DRISM-KH theory. Multi-Time-Step molecular dynamics with optimized isokinetic nose-hoover (OIN) thermostat coupled with 3D-RISM-KH molecular theory of solvation and generalized solvation force extrapolation (MTS-MD/OIN/3D-RISM-KH/GSFE) provides quasidynamics description of biomolecules. Validation included folding of miniprotein in solution from fully extended to equilibrated state in 60 ns, which provides acceleration by two orders of magnitude time scale, compared to 4–9 μs protein folding in experiment. Recent applications of 3D-RISM-KH molecular solvation theory consist in multiscale coupling of quantum chemistry, molecular solvation theory, molecular dynamics, and dissipative particle dynamics.

Recent Publications

1. Kovalenko, A. In: *Molecular Theory of Solvation.* Hirata, F. (Ed.) Series: Understanding Chemical Reactivity, Kluwer, Dordrecht, 2003, Vol. 24, pp.169–275.
2. Kovalenko, A. Multiscale Modeling of Solvation. In: *Springer Handbook of Electrochemical Energy*, pp. 95-139. Breitkopf, C.; Swider-Lyons, K. (Eds.) Springer-Verlag Berlin Heidelberg, 2017, 1016p.
3. Gusarov, S.; Ziegler, T.; Kovalenko, A. *J. Phys. Chem. A,* 2006, 110, 6083.
4. Casanova, D.; Gusarov, S.; Kovalenko, A.; Ziegler, T. *J. Chem. Theory Comput.,* 2007, 3, 458.
5. Kaminski, J.W.; Gusarov, S.; Wesolowski, T.A.; Kovalenko, A. *J. Phys. Chem. A,* 2010, 114, 6082.
6. Malvaldi, M.; Bruzzone, S.; Chiappe, C.; Gusarov, S.; Kovalenko, A. *J. Phys. Chem. B,* 2009, 113, 3536.

Biography

Andriy Kovalenko is Senior Research Officer at the National Institute for Nanotechnology, and Adjunct Professor in the Department of Mechanical Engineering at the University of Alberta, Edmonton, Canada. He has completed his PhD in Theoretical and Mathematical Physics at Lviv State University, Bogolyubov's Institute in 1993. He has been developing methodology and software implementation of statistical-mechanical, molecular theory of solvation, coupling it with electronic structure theories, molecular simulations, and docking protocols in a platform of predictive multiscale theory and modeling of chemical, supramolecular, and biomolecular systems for new advances of a general framework of multiscale methods.

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