20th International Conference on

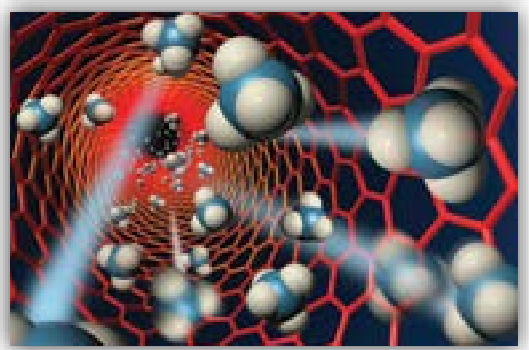
Advanced Nanotechnology

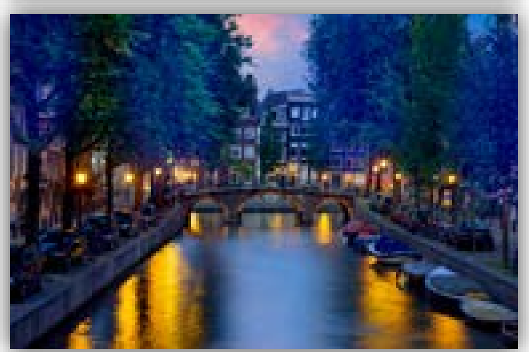
September 11-12, 2017 Amsterdam, Netherlands

Scientific Tracks & Abstracts

Day 1

Advanced Nano 2017





Advanced Nanomaterials | Nano Particles| Material science | Nanostructures | Nanomaterials

Session Chair
Jan Weyher
Institute of High Pressure Physics - Polish Academy of Sciences, Poland

Session Co-chair
Claire Deeb
University of Paris-Saclay, France

Session Introduction

Title: Deformation rate dependence of atomic force microscope based nanomechanical measurements

Samuel Lesko, Bruker Nano GmbH, France

Title: Nanoelectronics based on ultra-Robust metal-Terpyridine oligomer films and chemical or optical molecular switches

Wrochem Florian, Sony corporate labs, Germany

Title: AFM characterization of the physicochemical properties and activity of single protein molecules CYP 102A1 (BM3)

Yuri Ivanov, Institute of biomedical chemistry, Moscow, Russia

Title: Nanofiber technology for 3D nano-Biointerface fabrication and cellular engineering

Menglin Chen, Aarhus University, Denmark

Samuel Lesko et al., Nano Res Appl 2017, 3:3
DOI: 10.21767/2471-9838-C1-002

Deformation rate dependence of atomic force microscope based nano-mechanical measurements

Samuel Lesko[1], **Bede Pittenger**[2], **Jianli He**[2], **Lin Huang**[2], **Thomas Mueller**[2] and **Peter De Wolf**[2]
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The mechanical properties and extent of sub-micron features in polymer blends and composites are of interest due to their influence on macroscopic material performance. Atomic force microscopy is a natural tool to study these materials due to its high resolution and its ability to directly probe the mechanical properties of the sample. Over the past two decades, AFM based mechanical property mapping techniques have evolved from slow force volume to much faster dynamic measurements using TappingMode and contact resonance. Recently, real-time control of the peak force of the tip-sample interaction has led to a fundamental change in AFM imaging, providing force-volume-like quantitative mapping of mechanical properties at reasonable scan rates and very high resolution, even on soft materials. During material property mapping, the time scale of tip-sample interaction now spans from microseconds to seconds, tip sample forces can be controlled from piconewtons to micronewtons, and spatial resolution can reach sub-nanometer. This has enabled AFM to become a unique mechanical measurement tool having large dynamic range (1 kPa to over 300 GPa in elastic modulus) with the flexibility to integrate with other physical property characterization techniques. In addition to elastic and plastic properties, researchers have begun to take advantage of the wide range of deformation rates accessible to AFM in order to study time dependent properties of materials such as viscoelasticity. More traditional measurements with indentation DMA are usually limited in frequency to a few 100 Hz and have limited spatial resolution. In contrast, AFM measurements can extend from less than 1 Hz to kHz and beyond while retaining the high resolution needed to see the details in distribution of properties near domain boundaries in nanocomposites and thin films. This presentation will review this recent progress, providing examples that demonstrate the dynamic range of the measurements, and the speed and resolution with which they were obtained. Additionally, the effect of time dependent material properties on the measurements will be discussed.

Biography

Samuel LESKO is currently working as an Applications Manager at EMEA & Latin America | Bruker Nano Surfaces Division

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Notes:

Yuri Ivanov et al., Nano Res Appl 2017, 3:3
DOI: 10.21767/2471-9838-C1-002

AFM characterization of the physicochemical properties and activity of single protein molecules of CYP 102A1 (BM3)

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Atomic force microscopy (AFM) is a nano-technological multifunctional molecular platform for measuring of physicochemical and functional properties of single proteins molecules. AFM was used for visualization of oligomeric state, activity, elasticity and electron transfer of single molecules of CYP 102A1 (BM3). It was shown that BM3 in water solution exists as monomer, dimer, trimer, tetramer and oligomers of higher order by use sharp and super sharp AFM probes. Functional activity of single monomers and oligomers of BM3 was measured by AFM. The height BM3 fluctuations amplitude during catalytic cycle is much larger than the height fluctuations amplitude of the enzyme molecules in the resting state. It was found that an average amplitude of height oscillations of P450 BM3 molecule of dimers during catalytic cycle increased up to 5.0±2Å*s-1 that was 2.5 times larger than an average amplitude of P450 BM3 height oscillations in the resting state. It was obtained that the height fluctuation amplitude of single globule of cytochrome P450 BM3 depends on temperature, and 22˚C is a peak of this temperature profile. Mass spectrometry (MS) measurements were used to obtain a time course of a hydroxylation product of lauric acid oxidation during the enzymatic reaction of P450 BM3 in two cases: when enzyme was solubilized in the volume and when it was immobilized on the AFM chip. In both cases the number of enzyme molecules was 10^{10}, and the kinetics was linear during the first 10 minutes. It was shown that in the case of solubilized enzyme $k_{cat}=10^{-3}$ s-1, and in the case of immobilized enzyme $k_{cat}=0.4*10^{-3}$ s^{-1} that was 2.5 times less than the first one. Elasticity of single protein was measured based on deformation of this protein under AFM probes with various radii of curvature. Young's modulus of BM3 molecules depends on AFM modes. Based on the obtained data, the following conclusions may be made: the enzyme catalytic activity of single molecules can be measured as amplitude of enzyme globule fluctuations.

Biography

Yuri D. Ivanov was born in Alexin, Russia, in 1959. He graduated from the Moscow Engineering Physical Institute (MEPHI) in 1982. He received his PhD in Physics from the MEPHI in 1988 and Dr Sci. in Biol. from the Institute of Biomedical Chemistry RAMS (Moscow) in 2000. From 2000 to present he has been a head of laboratory of nanobiotechnology at the Institute of Biomedical Chemistry RAMS. His current research interest is nanotechnology approaches for the investigation of protein complexes.

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Florian Von Wrochem, Nano Res Appl 2017, 3:3
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Nano electronics based on ultra-robust metal-terpyridine oligomer films and chemical or optical molecular switches

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Considerable efforts have been undertaken within the past decades to shift organic-based thin-film devices to the application level. However, a major obstacle is given by the thermal deposition of metal electrodes, which remained elusive due to the damage and the electrical shorts experienced by the fragile molecular layers. Here, we show that large area molecular junctions of outstanding electronic properties and robustness can be realized using densely packed molecular wires consisting of Fe^{II}-terpyridine complex oligomers. Surprisingly, these ultrathin oligomer-based devices are stable for over 2 years under regular current-voltage cycling, withstanding a wide range of temperatures (150-360 K) and applied voltages (3 V), so, offering a perspective to a robust platform for molecular electronics. In the second part of the talk, we demonstrate switching materials for memory applications by means of two different approaches – a chemical and a biochemical – to ultrathin molecular switching layers. In the first system, remarkable resistive switching has been obtained with tetraaniline layers and tetraaniline/PEDOT blends, switched by proton doping, to yield on/off ratios of up to 105. In the second approach, we make use of Sn-cyt c protein layers to show that they act as reversible and highly efficient photo-electrochemical switches, even upon integration into large area solid state junctions. Photocurrents are observed both in the Soret-band (□=405 nm) and in the Q-band (□=535 nm), with current on/off ratios reaching values of up to 25, so making protein photo detectors a realistic scenario.

Biography

Florian Von Wrochem is a Principal Scientist and Project Leader at Materials Science Laboratory of Sony Corporate labs (Stuttgart, Germany). He received his PhD in Physics from the University of Basel in 2007 in parallel with his R&D activities at the Sony Europe. The research in his group is addressing the development of novel organic and molecular electronic devices, e.g. memories and logic circuits for flexible electronics. These activities involve the fabrication and electrical characterization of organic opto-electronic devices at the nano and micro scale, the spectroscopic and topographic investigation of surfaces and interfaces, as well as the design and synthesis of functional materials.

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Day 2

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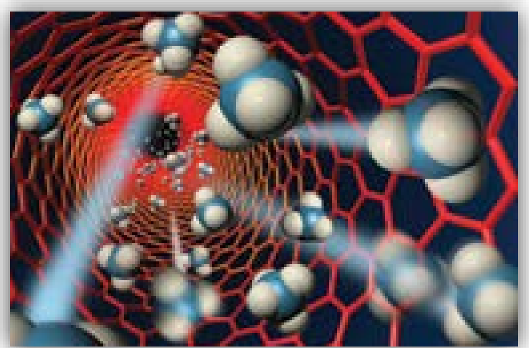

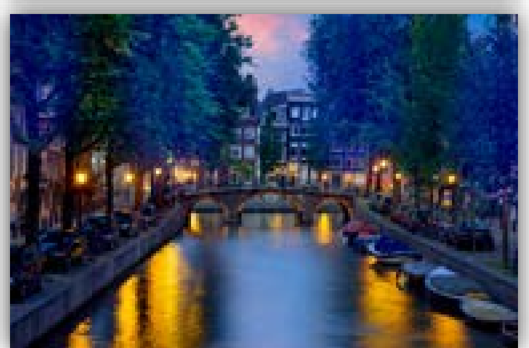

Nano photonics | Nanomedicine | Nano Science and Technology | Applications of Nanotechnology | Nano Electronics

Session Chair
Mato Knez
CIC nanoGUNE, Spain

Session Co-chair
Vasily Temnov
University of Maine, France

Session Introduction

Title: **Electrical properties of single ZnO nanowires prepared by wet and dry methods**
Andreea Costas, National Institute of Materials Physics, Romania

Title: **Electrical properties of single core-Shell metal oxide nanowires**
Camelia Florica, National Institute of Materials Physics, Romania

Young Research Forum

YRF: **Preparation and study on radar absorbing materials of epoxy-Fe3O4 composites and the influence of PANI on microwave absorbing properties of NiFe2O4/PVB composites**
Yuksel AKINAY, University of Karabuk, Turkey

YRF: **Maintaining biomolecules native conformation upon surface immobilization and extracting their size and shape: A study employing the QCM-D biosensor**
Dimitra Milioni, Institute of Molecular Biology and Biotechnology - Foundation for Research and Technology Hellas, Greece

YRF: **Investigation of the effect of indium and arsonic on the photoluminescence properties of in GaPN and GaAsPN solar cell**
Hind Albalawi, Nottingham University,UK

YRF: **Multiple hot spots 3D nanostructures: Ultrasensitive substrates for surface-Enhanced raman spectroscopy**
Andrea Cerea, University of Genova, Italy

Costas A et al., Nano Res Appl 2017, 3:3
DOI: 10.21767/2471-9838-C1-002

Electrical properties of single ZnO nanowires prepared by wet and dry methods

Costas A, **Florica F**, **Kuncser A**, **Preda N** and **Enculescu I**
National Institute of Materials Physics, Romania

In the last decades, nanowires have become the building blocks for new nanotechnology devices. Compared to bulk materials, nanowires have high aspect ratio and unique electrical, optical and magnetic properties that can be easily tuned by controlling the parameters involved in the growth process. ZnO is an n type semiconductor material with a direct wide band gap (3.3 eV) and a large exciting binding energy (60 meV) that crystallizes in two main phases, hexagonal wurtzite and cubic zinc blende. ZnO nanowires are the perfect candidates for many applications, such as gas sensor, light-emitting diodes, field effect transistors, photo-detectors, photocatalysts, solar cells and many others. In this work, arrays of ZnO nanowires have been prepared using wet and dry methods (electrochemical deposition, chemical bath deposition and thermal oxidation in air). The structural (X-ray diffraction, transmission electron microscopy), optical (reflection, photoluminescence), morphological (scanning electron microscopy), compositional (energy-dispersive X-ray spectroscopy) and electrical properties (current-voltage characteristics) were investigated in order to increase their performance in different applications. By employing lithographic techniques (photolithography and electron beam lithography) and thin films deposition techniques, single ZnO nanowires prepared by wet and dry methods, were integrated into devices like field effect transistors. We observed that the growth method influence the structural, morphological, optical and electrical properties of the nanowires. Thus, the method used to synthesize the nanowires represents the key in obtaining high performance electronic devices.

Biography

Costas A has completed her PhD at University of Bucharest, Romania. She is a young Researcher with 10 publications that have been cited over 20 times, and her publication H-index is four. She is currently working as a Researcher at National Institute of Materials Physics and she is involved as a team member in more than five national research projects.

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Notes:

Florica C et al., Nano Res Appl 2017, 3:3
DOI: 10.21767/2471-9838-C1-002

Electrical properties of single core-shell metal oxide nanowires

Florica C, Costas A, Kuncser A, Boni A G, Preda N and **Enculescu I**
National Institute of Materials Physics, Romania

Metal oxide materials are the focus of many researchers being often used due to their abundance in nature and low environmental impact. Topics have been going recently towards the nanoscale because of the diverse, yet unique characteristics given by the low dimensions together with reducing the amount of employed material. The particular properties of nanowires make them suitable for applications such as high sensitivity sensors, catalysis, power generators, etc. ZnO nanowires have a high surface to volume ratio and exhibit special electrical properties with applications in field effect transistors, diodes. However, they are interacting with the surroundings, even dissolving in the presence of more acidic environment and in order to affect this occurrence a shell material is proposed. The ZnO nanowires are prepared by thermal oxidation in air at 500°C on zinc foils and on top of it a thin layer of CuO is deposited by magnetron sputtering. The structural, morphological, optical and electrical properties of the prepared nanowires are investigated before and after the shell deposition. Moreover, the nanowires were transferred in alcohol and single nanowires were contacted using photolithography and e-beam lithography and their electrical response was measured at various temperatures. Differences between the bare ZnO nanowires and their core-shell counterparts are evidenced.

Biography

Florica C has completed her PhD at University of Bucharest, Romania. She is a young researcher with over 25 publications that have been cited over 75 times, and her publication H-index is 5. She is currently leading a national research project on the topic of core-shell nanowires.

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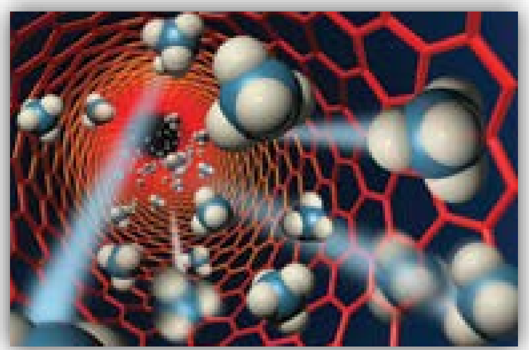

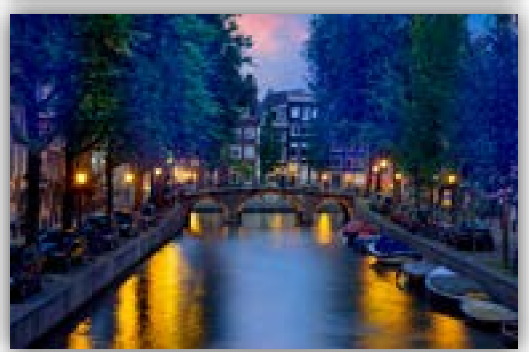

H Albalawi et al., Nano Res Appl 2017, 3:3
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Investigation of the effect of indium and arsenic on the photoluminescence properties of InGaPN and GaAsPN solar cell

H Albalawi, S Almosni, H Vinicius, Y Gobato, C Cornet and **M Henini**
Nottingham University, UK

Concentrated multi-junction solar cells (MJSC) which are grown by either molecular beam epitaxy (MBE) or metalorganic vapour phase epitaxy (MOVPE) have the highest efficiencies of photovoltaic (PV). The optical properties of both bulk GaAsPN and InGaPN, which are grown on GaP have been investigated using photoluminescence (PL) for solar cell applications and compared with that of GaPN layers. The target energy has to be reached is 1.7~1.8 eV for solar cells. InGaPN shows a great PL intensity at this energy under 140K. Indeed, S-shape was observed which is mainly due to the fluctuation of band gap energy related to In and N content. In contrast, GaAsPN presents lower intensity at the same conditions. GaAsPN presented poor behaviour at room temperature. Rapid thermal annealing (RTA) under 800 °C for 5 minutes was done to both samples to carry out the effect of it. RTA helps to treat the PL intensity by improve it but the energy peak is red shifted.

Biography

Hind Albalawi is a PhD Researcher at University of Nottingham, UK. She completed her MSc in Renewable Energy and Architecture at Nottingham University, UK. She is working mainly on semiconductors for solar cells.

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Dimitra Milioni et al., Nano Res Appl 2017, 3:3
DOI: 10.21767/2471-9838-C1-002

Maintaining biomolecules' native conformation upon surface immobilization and extracting their size and shape: a study employing the QCM-D biosensor

Dimitra Milioni[1], A Tsortos[1] and **E Gizeli[1, 2]**
[1]Institute of Molecular Biology & Biotechnology-FORTH, Greece
[2]University of Crete, Greece

Studying bio-molecular conformation is of extremely great importance in the fields of biology and nano-biotechnology. The ability to maintain and study the biomolecule's native conformation is crucial, as the latter is directly related to the molecule's properties and functions. For this purpose, in this work we used anchors for immobilizing different biomolecules on an acoustic biosensor surface via single-point attachment. The biosensor response provides information directly related to the geometrical features of the probed molecule. More precisely, we used the Quartz Crystal Microbalance with Dissipation monitoring (QCM-D) technique; as an acoustic wave propagates through a medium containing the molecules of interest, any change occurring in its characteristics, such as the propagation frequency (F) and the energy dissipation (D), can be linked to changes in the concentration and/or the conformation of the biomolecules bound on the surface. The scientific principle behind the new approach described here is that the acoustic ratio (ΔD/ΔF) is a measure of the hydrodynamic volume of the attached entity, mathematically expressed by its intrinsic viscosity [η]. We have already used this approach for diagnostic purposes, including detection of SNPs or targets of different lengths in real samples. Here, we expand this methodology by specifically attaching discrete biomolecules on the biosensor surface using DNA molecules as single point and variable length anchors. The native conformation of the biomolecules is thus maintained and their conformation, i.e. shape and length, is correctly predicted through acoustic measurements.

Biography

Dimitra Milioni obtained her Diploma in Applied Physics at NTUA, Athens, Greece. She completed her MSc in Molecular and Cellular Biophysics at Pierre et Marie Curie University (Paris VI, France) and PhD in Biophysics at the same University in 2012. After spending some months as Visiting Researcher in Molecular Modeling and Drug Design Laboratory, she is a Post-doctoral Researcher in Biosensors Lab at Institute of Molecular Biology and Biotechnology, Foundation for Research and Technology-Hellas-IMBB-FORTH, Greece. Her scientific interests focus on "Biosensors, plasma membrane and model membranes as well as on their interaction with other biomolecules (biocompatible polymers, pore-forming toxins and antimicrobial peptides) and drug delivery".

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Notes:

Andrea Cerea et al., Nano Res Appl 2017, 3:3
DOI: 10.21767/2471-9838-C1-002

Multiple hot spots 3D nanostructures: ultrasensitive substrates for surface-enhanced Raman spectroscopy

Andrea Cerea[1, 2], **Manohar Chirumamilla**[1, 3], **Anisha Gopalakrishnan**[3], and **Andrea Toma**[1]
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[3]University of Aalborg, Denmark

Over the last few years, great efforts have been made in order to increase the performances of sensors down to ultralow concentrations (10-15 м) of analyte molecules, with exceptional consequences in the fields of photonics, nonlinear optics and imaging. Within this context, Surface Enhanced Raman Spectroscopy (SERS) provides label-free detection of analytes down to the single-molecule level with high specificity and sensitivity. Conventional and cost-effective approaches exploit bottom-up techniques for the realization of large SERS substrates with a random and high density distribution of active sites, also called hot spots. Complementary strategies employ top-down methods, which allow the realization of high uniformity SERS active surfaces with precise control over the position, size and shape of the hot spots. By taking advantage of the interaction between analyte molecules and enhanced optical near-fields in the vicinity of resonantly excited plasmonic nanostructures, plasmon-based devices represent a good candidate for SERS. Here, we present the realization and experimental characterization of 3D multi-branched nanostructures as a viable strategy for intense electric hot-spot generation and SERS applications. Our structures, arranged in isolated or coupled configuration, support intense localized surface plasmon resonances (LSPRs) with an associated giant electromagnetic (EM) field confinement and enhancement factors up to 108. Further developments of our 3D nanostructures have led to the realization of bimetallic Au/Ag nanostructures with a multi-branched geometry. This novel architecture integrates the advantages of extremely high EM field enhancement, owing to the plasmonic properties of Ag, with the excellent biocompatibility and chemical stability provided by the single metal Au analogue. Moreover, the present layout can support large hot spots densities comparable to those obtained with bottom-up techniques, although with greater reproducibility and precise control over the spatial location of the active areas.

Biography

Andrea Cerea is currently pursuing his PhD at University of Genoa and the Italian Institute of Technology. He is working in the Plasmon Nanotechnology Group, with focus on the development of photonic metamaterials for electromagnetic field manipulation.

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Notes:

Yuksel Akinay et al., Nano Res Appl 2017, 3:3
DOI: 10.21767/2471-9838-C1-002

Preparation and study on radar absorbing materials of epoxy-Fe3O4 composites and the influence of PANI on microwave absorbing properties of NiFe2O4/PVB composites

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Microwave absorption properties of epoxy matrix with magnetite fillers were investigated in this work. The composite were prepared via ultrasonic probe sonicator method in solution. The complex permittivity and permeability for epoxy matrix magnetite fillers radar absorbing composites were measured at different microwave frequencies via vector network analyzer. The obtained results describe the frequency dependence of permittivity and permeability with various powder percentage and composite thickness. The reflection loss (RL) of composites was calculated and evaluated from complex permittivity and permeability. The obtained results show that both composites exhibit the large RL and broadband within the frequency range from 1 to 14 GHz for different thickness. The results show that absorption has increased as the fillers rate increase and thickness is decreased. This can be understood based on quarter-wave principle within the frequency range from 1 GHz-14 GHz for different thickness.

The influence of polyaniline on microwave absorbing properties of polyvinylbutiral (PVB)/NiFe2O4 composites were investigated in the 1-14 GHz. In this sense, polyaniline (PANI) doped with para-toluene sulfonic acid were introduced into PVB matrix. PVB/filler particles (NiFe2O4) composites were prepared with 85/15 mixture ratios via Ultrasonic Probe Sonicator method in solution. The composite of PANI/PVB/NiFe2O4 (PANI:PVB = 1:3 and (PANI+PVB):NiFe2O4 = 85:15) was prepared via same method of PVB/NiFe2O4 composite. complex permittivity (ε'- jε''and permeability (μ'- jμ'') of the composites have been measured at different microwave frequencies in 1–14 GHz employing vector network analyzer (Keysight N9926A). The reflection loss (RL) of composites was calculated and evaluated using the theory of the absorbing wall. It was found that the addition of aniline has reduced the reflection loss values but increased the bandwidth within the frequency range from 1 GHz-14 GHz for different thickness.

Biography

Yuksel Akinay is a Research Assistant at Materials Research and Development Center of Karabük University, Turkey. He obtained his Bachelor's degree from Metallurgical and Material Engineering Department, University of Yıldız Technical University, Istanbul, Turkey, in 2010. He has a PhD degree. His research interests include polymer composite materials, nanocomposite, electromagnetic wave absorbing and micro-structure characterization..

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Video Presentation

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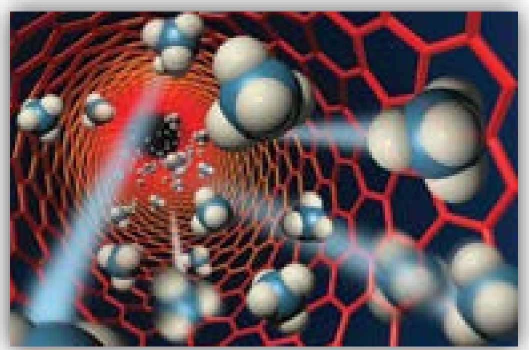

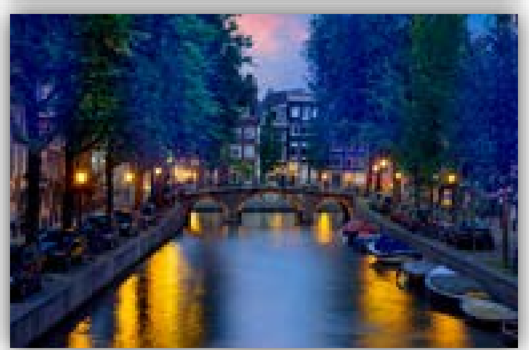

Peng-Sheng Wei, Nano Res Appl 2017, 3:3
DOI: 10.21767/2471-9838-C1-002

Molten region growth on an array of cylinders on metal surface subject to a pulsed laser beam

Peng-Sheng Wei and **Xi-Wan**
National Sun Yat-Sen University, Taiwan

This study numerically investigates heating and melting of different arrays of cylinders on a metal surface subject to an electromagnetic wave or laser beam in a TM mode. The TM mode represents magnetic field to be perpendicular to the incident plane of electrical field. A systematical investigation of heating and melting of an array of nanoparticles on a surface is essentially required to understand 3-D printing and different types of plasma processing and nanotechnology. The results show that electromagnetic wave propagating along the boundary between two media leads to a distributed energy input on the surface of the array. Free surface deformation of molten pool required more systematical understanding of complicated transport phenomena.

Biography

Peng-Sheng Wei received PhD in Mechanical Engineering department at University of California, Davis, in 1984. He has been a Professor in the Department of Mechanical and Electro-Mechanical Engineering of National Sun Yat-Sen University, Kaohsiung, Taiwan, since 1989. He has contributed to advance understanding of and to the applications of electron and laser beam and resistance welding through theoretical analyses coupled with verification experiments.

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