"Micro-Machined Fountain Pen for Atomic Force Microscope-Based Nanopatterning", Deladi, S., N.R. Tas, J.W. Berenschot, G.J.M. Krijnen, M.J. de Boer, J.H. de Boer, M. Peter and M.C. Elwenspoek, *Appl. Phys. Lett.*, **85** (2004), p. 5361.

- **December 2004:** ***Fluorescence Microscope Images Nanotubes Inside WBC's***

  Single-walled carbon nanotubes have been imaged inside white blood cells using near-infrared fluorescence microscope.

  "Near-Infrared Fluorescence Microscopy of Single-Walled Carbon Nanotubes in Phagocytic Cells", Cherukuri, P., S.M. Bachilo, S.H. Litovsky and R.B. Weisman, *J. Am. Chem. Soc.*, **126** (2004), p. 15638.

- **December 2004:** ***Nanotube-based Optical Sensors for Measuring Blood Sugar Levels***

  Near-infrared optical sensors have been made up of modified single-walled carbon nanotubes for measuring blood sugar levels.

  "Near-Infrared Optical Sensors based on Single-Walled Carbon Nanotubes", Barone, P.W., S. Baik, D.A. Heller and M.S. Strano, *Nature Materials*, **4** (2004), p. 86.

- **January 2005:** ***Polymers Synthesized Using DNA Nanomachine***

  A nanomechanical device that synthesizes different products according to their configuration has been made from DNA. This could find applications in the creation designer polymers, encryption of information, etc.

  "Translation of DNA Signals into Polymer Assembly Instructions", Liao, S. and N.C. Seeman, *Science*, **306** (2005), p. 2072.

- **January 2005:** ***Nanoscale Switch***

  A nanoscale mechanical switch has been made which can demonstrate basic logic circuits. In future, this could replace semiconductor switches of the electronic devices.

  "Quantized Conductance Atomic Switch", Terabe, K., T. Hasegawa, T. Nakayama and M. Aono, *Nature*, **433** (2005), p. 47.

- **January 2005:** ***Nanotubes to Sense Gas Attacks***

  When an atom or a molecule hits carbon nanotubes, there is found to be a change in its electrical resistivity. This could be well exploited by devices that use nanotubes as chemical sensors.

  "Atom Collision-Induced Resistivity of Carbon Nanotubes", Romero, H.E., K. Bolton, A. Rosén and P.C. Eklund, *Science*, **307** (2005), p. 89.

- **January 2005:** ***AFM with a Time Resolution of Microseconds***

  An atomic force microscope has been demonstrated to take images of periodic processes with a time resolution of micro-seconds, which is faster as compared to the normal rapid-scan.

  "Atomic Force Microscopy with Time Resolution of Micro-Seconds", Anwar, M. and I. Rousso, *Appl. Phys. Lett.*, **86** (2005), p. 014101.

- **January 2005:** ***Nanoneedle Attached to AFM for Nanoscale Operation***

  The nucleus of living cells has been operated upon using by nanoneedles attached to an atomic force microscope.

- **January 2005:** ***Carbon Nanotubes as Electrodes for Electrochemistry***

  Single walled carbon nanotubes have been used as nanoelectrodes for electrochemistry. These were contact by nanolithography and cyclic voltammetry was performed in aqueous solutions. This study demonstrates the potential of carbon nanotubes as nanoelectrodes.

  "Individual Single-Walled Carbon Nanotubes as Nanoelectrodes for Electrochemistry", Heller I., J. Kong, H.A. Heering, K.A. Williams, S.G. Lemay, and C. Dekker, *Nano Letters*, **5** (2005), p. 137.

- **January 2005:** ***Transistors from Carbon Nanotubes***

  Isolated single walled carbon nanotubes are used to construct field-effect transistors of less than 20 nm dimensions. This material could find practical use in the field of nanoelectronics in regulating the current and working of devices.

  "Sub-20 nm Short Channel Carbon Nanotubes Transistors", Seidel, R.V., A.P. Graham, J. Kretz, B. Rajasekharan, G.S. Duesberg, M. Liebau, E. Unger, F. Kreupl and W. Hoenlein, *Nano Letters*, **5** (2005), p. 147.

- **January 2005:** ***Aerosol based Approach for Synthesis of Carbon Nanotubes***

  A novel method to synthesize carbon nanotubes based on aerosols is demonstrated. Nanotubes of 0.6–2 nm diameter and 50 nm length was produced on a commercial scale using this method.

  "A Novel Aerosol Method for Single Walled Carbon Nanotubes Synthesis", Nasibulin, A.G., A. Moisala, D.P. Brown, H. Jiang and E.I. Kauppinen, *Chemical Physics Letters*, **402** (2005), p. 227.

- **January 2005:** ***Assembling Metallic Nanowires***

  Metallic nanowires have been grown and self-assembled from solution by application of external alternating electric field. The wires showed high electrical conductivity and this array could find use in gas sensors and serve as building blocks for electronic systems.

  "Self-Assembly of Metallic Nanowires from Aqueous Solution", Cheng D., R.K. Gonela, Q. Gu and D.T. Haynie, *Nano Letters*, **5** (2005), p. 175.

- **January 2005:** ***Nanorotors that Double up as Catalyst***

  Barcoded gold-nickel nanorods, anchored onto a silicon surface demonstrate rotational motion while catalysing the decomposition of hydrogen peroxide. This discovery presents an important milestone where the catalytic system doubles up as a movable rotor. This will lead to development of nanomechanical actuators and movable parts, useful for fabricating nanodevices.

  "Synthetic Self-Propelled Nanorotors", Fournier-Bodoz, S., A.C. Arsenault, I. Manner and G.A. Ozin, *Chemical Communications*, **4** (2005), p. 441.

- **January 2005:** ***Clusters Exhibiting Near-infrared Luminescence***

  Monolayer-protected gold clusters have been shown to exhibit visible-near-infrared luminescence. The luminescence which could be tuned by controlling the core diameter and capping ligands presents interesting development in the field of optoelectronic devices.

  "Near-IR Luminescence of Monolayer-Protected Metal Clusters", Wang, G.L., T. Huang, R.W. Murray, L. Menard and R.G. Nuzzo, *J. Am. Chem. Soc.*, **127** (2005), p. 812.

- **February 2005:** ***Nanoparticles to Detect Alzheimer's-related Proteins***

  The concentration of amyloid- β -diffusible ligands (ADDLs) in cerebrospinal fluid has been measured by using a nanoparticle-based bio-barcode assay. This technique could provide a method for the early dignosis of Alzheimer's disease, as ADDLs are likely markers for it.

  "Nanoparticle-Based Detection in Cerebral Spinal Fluid of a Soluble Pathogenic Biomarker for Alzheimer's Disease", Georganopoulou, D.G., L. Chang, Jwa-Min Nam, C.S. Thaxton, E.J. Mufson, W.L. Klein and C.A. Mirkin, *PNAS*, **102** (2005), p. 2273.

- **February 2005:** ***Coaxial Nanotubes to Form Buckypaper***

  A high-yield technique for making double-walled carbon nanotubes has been developed, wherein their structures could have superior physical properties as compared to those of single- or multi-walled carbon nanotubes.

  "Nanotechnology: 'Buckypaper' from Coaxial Nanotubes", Endo, M., H. Muramatsu, T. Hayashi, Y.A. Kim, M. Terrones and M.S. Dresselhaus, *Nature*, **433** (2005), p. 476.

- **February 2005:** ***End States Viewed in 1D Atom Chains***

  For the first time, end-states in 1D atom chains have been observed. This could have applications in nanoelectronics, as it would improve our understanding of electronic properties in one-dimensional structures.

  "End-States in One-Dimensional Atom Chains", Crain, J.N. and D.T. Pierce, *Science*, **307** (2005), p. 703.

- **February 2005:** ***Nanobelts to Detect Nerve Agents***

  For detecting nerve agents, sensors have been made by combining tin oxide 'nanobelts' with low-power micro-heaters. These are ultrastable, highly sensitive and free from the 'Poisoning effect' of metal oxides as found in the previous sensors.

  "Integration of Metal Oxide Nanobelts with Microsystems for Nerve Agent Detection", Yu, C., Q. Hao, S. Saha, L. Shi, X. Kong and Z.L. Wang, *Appl. Phys. Lett.*, **86** (2005), p. 063101.

- **February 2005:** ***Nanotube Formation Aided by Liquid Carbon***

  Liquid carbon has been found to be involved in the formation of multi-walled carbon nanotubes. These are believed to form by homogenous nucleation inside the liquid droplets.

  "Liquid Carbon, Carbon-Glass Beads, and the Crystallization of Carbon Nanotubes", de Heer, W.A., P. Poncharal, C. Berger, J. Gezo, Z. Song, J. Bettini and D. Ugarte, *Science*, **307** (2005), p. 907.

- **February 2005:** ***Hydrogen Storage Capabilities Improved by Carbon Nanotubes***

  The hydrogen sorption properties of catalyzed sodium alanates were found to improve by the use of single-walled carbon nanotubes. The sorption kinetics of the material also improved by a factor of four by using these nanotubes.

  "The Catalytic Effect of Single-Wall Carbon Nanotubes on the Hydrogen Sorption Properties of Sodium Alanates", Dehouche, Z., L. Lafi, N. Grimard, J. Goyette and R. Chahine, *Nanotechnology*, **16** (2005), p. 402.

- **February 2005:** ***Si Nanowire Sensors for Helping Drug Discovery***

  For detecting interactions between small molecules and proteins, a silicon nanowire sensor has been created and this could have applications in drug discovery.

  "Label-Free Detection of Small-Molecule–Protein Interactions by Using Nanowire Nanosensors", Wang, W.U., C. Chen, Keng-hui Lin, Y. Fang and C.M. Lieber, *PNAS*, **102** (2005), p. 3208.

- **February 2005:** ***Nanotube Coating for Pyroelectric Detectors***

  The use of single-walled carbon nanotubes as a thermal-absorption coating for pyroelectric detectors has been investigated. This could have applications in measuring the optical power laser of systems.

  "Single-Wall Carbon Nanotube Coating on a Pyroelectric Detector", Lehman, J.H., C. Engtrakul, T. Gennett and A.C. Dillon, *Applied Optics*, **44** (2005), p. 483.

- **February 2005:** ***Sonochemical Preparation of Hollow Nanospheres***

  Hollow nanospheres and hollow nanocrystals of molybdenum compounds have been prepared using ultrasound. These could have applications in catalysis, microelectronics and photonics.

  "Sonochemical Preparation of Hollow Nanospheres and Hollow Nanocrystals", Dhas, N.A. and K.S. Suslick, *J. Am. Chem. Soc.*, **127** (2005), p. 2368.

- **February 2005:** ***Solar Cells based on Nanocluster Composites Exhibit Unprecedented Efficiency***

  Porphyrin modified gold nanoparticles are complexed with fullerene molecules and assembled into arrays on nanostructured SnO_2 substrate. This electrode exhibits an incident photo-to-photocurrent efficiency of 54% and an efficiency of 1.5%. These numbers are around 45 times higher than cells fabricated with porphyrins or fullerenes as the sole component.

  "Photovoltaic Cells Using Composite Nanoclusters of Porphyrins and Fullerenes with Gold Nanoparticles", Hasobe, T., H. Imahori, P.V. Kamat, T.K. Ahn, S.K. Kim, D. Kim, A. Fujimoto, T. Hirakawa and S. Fukuzumi, *J. Am. Chem. Soc.*, **127** (2005), p. 1216.

- **February 2005:** ***Buckypaper from Carbon Nanotubes***

  A high-yield technique for making double-walled carbon nanotubes has been developed, wherein their structures could have superior physical properties as compared to those of single- or multi-walled carbon nanotubes.

  "Buckypaper from Coaxial Nanotubes", Endo, M., H. Muramatsu, T. Hayashi, Y.A. Kim, M. Terrones and N.S. Dresselhaus, *Nature*, **433** (2005), p. 476.

- **February 2005:** ***Manipulating and Working with Atoms***

  Highly controlled manipulations of atoms at room temperature have been achieved using atomic force microscopy. This is of importance for fabrication of nanoscale devices with atomic precision.

  "Atom Inlays Performed at Room Temperature Using Atomic Force Microscopy", Sugimoto, Y., M. Abe, S. Hirayam, N. Oyabu, O. Custance and S. Morita, *Nature Materials*, **4** (2005), p. 156.

- **February 2005:** ***Nanocrystal Emitting Blue Laser***

  Semiconductor nanocrystals emitting blue laser have been developed. Core-shell systems of CdS/ZnS stabilized in sol-derived silica matrix show lasing properties at room temperature. This could further research for developing tunable emission from such systems.

"Blue Semiconductor Nanocrystal Laser", Chan, Y., J.S. Steckel, P.T. Snee, J.M. Cargue, J.M. Hodgkiss, D.G. Nocera, and M.G. Bawendi, *Appl. Phys. Lett.*, **86** (2005), Art. No. 073102.

- **February 2005:** ***Nanoparticle Coated Self-cleaning Surface***

  Coating silica and titania nanoparticles on glass substrates transformed them into self-cleaning surface with good anti-reflective properties. The commercialization of this technology would have a huge impact in semiconductor and coating industry.

  "Self-cleaning Particle Coating with Antireflective Properties", Zhang, X.T., O. Sato, M. Tauchi, Y. Einaga, T. Murakami and A. Fujishima, *Chemistry of Materials*, **17** (2005), p. 696.

- **March 2005:** ***Bimetallic Nanoparticle Catalysts to Clean up Trichloroethene***

  The palladium-coated gold nanoparticles have been found to be extremely effective catalysts for breaking down trichloroethene into less harmful products, which has serious implications for human health and environment.

  "Designing Pd-on-Au Bimetallic Nanoparticle Catalysts for Trichloroethene Hydrodechlorination", Nutt, M.O., J.B. Hughes and M.S. Wong, *Environ. Sci. Technol.*, **39** (2005), p. 1346.

- **March 2005:** ***Nanoparticle/Copolymer Mixtures to Direct their Self-assembly***

  By adding nanoparticles to diblock copolymers, it has been found that they can redirect their self-assembly. This technique could find applications for chemical sensing, separation, catalysis, etc.

  "Self-Directed Self-Assembly of Nanoparticle/Copolymer Mixtures", Lin, Y., A. Böker, J. He, K. Sill, H. Xiang, C. Abetz, X. Li, J. Wang, T. Emrick, S. Long, Q. Wang, A. Balazs and T.P. Russell, *Nature*, **434** (2005), p. 55.

- **March 2005:** ***Molecular Switch Shows Negative Differential Resistance***

  A single molecule attached to two electrodes has been found to show a negative differential resistance. This may be a valuable technique for future research in single-molecule electronics.

  "A Molecular Switch Based on Potential-Induced Changes of Oxidation State", Chen, F., J. He, C. Nuckolls, T. Roberts, J.E. Klare and S. Lindsay, *NanoLetters*, **5** (2005), p. 503.

- **March 2005:** ***CdSe Nanoparticle-based Active Tips for NSOM***

  For a near-field scanning optical microscopy, an active optical tip has been created with just a few CdSe nanoparticles at its apex. This tip may even be believed to contain just one nanoparticle.

  "CdSe Single-Nanoparticle-Based Active Tips for Near-Field Optical Microscopy", Chevalier, N., M.J. Nasse, J.C. Woehl, P. Reiss, J. Bleuse, F. Chandezon and S Huant, *Nanotechnology*, **16** (2005), p. 613.

- **March 2005:** ***Controlled Evolution of Polymer Crystals on Mica***

  An AFM coated with a polymer has been used for growing crystals of the polymer on a mica substrate. This new technique is capable of starting crystallization from scratch, then controlling and imaging the process as it proceeds in real-time.

  "The Controlled Evolution of a Polymer Single Crystal", Liu, X., Y. Zhang, D.K. Goswami, J.S. Okasinski, K. Salaita, P. Sun, M.J. Bedzyk and C.A. Mirkin, *Science*, **307** (2005), p. 1763.

- **March 2005:** ***Bacteria Trapped at Electrode Junctions***

  Electric fields have been used to manipulate bacteria into a gap between two electrodes. By measuring changes in the electrical performance of the device, it was possible to detect that the bacteria were in position.

  "Manipulation and Real-Time Electrical Detection of Individual Bacterial Cells at Electrode Junctions: A Model for Assembly of Nanoscale Biosystems", Beck, J.D., L. Shang, M.S. Marcus and R.J. Hamers, *Nano Letters*, **5** (2005), p. 777.

- **March 2005:** ***Surface Tension to Drive Nanomotors***

  A nanoelectromechanical device known as 'relaxation oscillator', which exploits the effects of surface tension, has been made for the first time. This device consists of two droplets of liquid metal on a substrate made of carbon nanotubes, which can be controlled with a small-applied electric field.

  "Surface-Tension-Driven Nanoelectromechanical Relaxation Oscillator", Regan, B.C., S. Aloni, K. Jensen and A. Zettl, *Appl. Phys. Lett.*, **86** (2005), p. 123119.

- **March 2005:** ***Polymer-coated Au Nanoparticles for Heat Transport***

  In the case of polymer-coated gold nanoparticles, it was found that on adding a solvent, the polymer coating swelled leading to a sudden rise in the thermal conductivity of the layer.

  "Thermal Transport in Au-Core Polymer-Shell Nanoparticles", Ge, Z., Y. Kang, T.A. Taton, P.V. Braun and D.G. Cahill, *Nano Letters*, **5** (2005), p. 531.

- **March 2005:** ***Nanotube Capacitor to Detect Vapors***

  Chemical vapors have been detected by using the capacitance changes occurring in a network of single-walled carbon nanotubes. This technique is sensitive to a broad range of gases and also emits a fast response.

  "Chemical Detection with a Single-Walled Carbon Nanotube Capacitor", Snow, E.S., F.K. Perkins, E.J. Houser, S.C. Badescu and T.L. Reinecke, *Science*, **307** (2005), p. 1942.

- **March 2005:** ***Drawing Sheets of Carbon Nanotubes***

  Polymerization of caprolactum in presence of single-walled carbon nanotubes leads to the formation of composite with optimized morphology. This composite could be drawn into sheets with improved mechanical properties, for use in optoelectronics.

  "Continuous Spinning of a Single Walled Carbon Nanotube-Nylon Composite Fibre", Gao, B., M.E. Itkis, A.P. Yu, Bekyarova, B. Zhao and R.C. Haddon, *J. Am. Chem. Soc.*, **127** (2005), p. 3847.

- **March 2005:** ***Ordered Silicon Nanowire Arrays***

  Gold nanoparticles are used as seeds to grow highly ordered silicon nanowire arrays, with the growth taking place perpendicular to the substrate. This materials will find applications in nanoelectronics and easily integrate into nanoscale devices.

  "Controlled Growth of Si Nanowire Arrays for Device Integration", Hochbaum, A.I., R. Fan, R.R. He, P.D. Yang, *Nano Letters*, **5** (2005), p. 457.