

Strong Magnetic-Field Treatment Strengthens NiAl-Cr(Mo)-Hf Alloy

NiAl-Cr(Mo)-Hf alloys offer significant potential for use as high-temperature, lightweight structural materials. They show good strength at high temperatures, good oxidation resistance, and high wear resistance. These alloys, however, are very brittle and have low tensile strengths, particularly at room temperature. Various efforts to improve the ductility of these alloys have been marginally successful. A method has now been reported to significantly improve the ductility and bending strength of the alloy. By subjecting a NiAl-Cr(Mo)-Hf alloy to a high magnetic field, G.J. Ma and W.L. Zhou of the Dalian University of Technology, J.T. Guo of the Shengyang Institute of Materials Research, and their co-workers have increased the bending strength of the alloy by 75%.

As reported in the February 2005 issue of the *Journal of Materials Research* (p. 295; DOI: 10.1557/JMR.2005.0047), rectangular

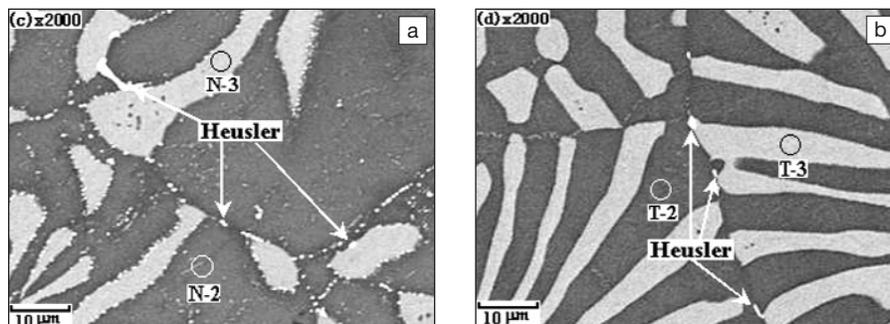


Figure 1. Electron probe microanalysis of the microstructures (a) without magnetic-field treatment, in which N-2 represents the NiAl phase and N-3 represents the Cr(Mo) phase; and (b) after magnetic-field treatment, in which T-2 represents the NiAl phase and T-3 represents the Cr(Mo) phase. Reproduced with permission from the *Journal of Materials Research* **20** (2) (February 2005), p. 295; DOI: 10.1557/JMR.2005.0047. © 2005 Materials Research Society.

cross-sectional NiAl-Cr(Mo)-Hf alloy specimens, formed from a nominal composition of Ni-33Al-28Cr-5.5Mo-0.5Hf, were heated to 900°C under a 10 T homo-

geneous high magnetic field. Upon cooling to room temperature, the bending strength of the specimens was characterized using the three-point bending

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method. While the average bending strength of the untreated alloy was 245 MPa, the average bending strength of the alloy treated with the magnetic field was 430 MPa, roughly a 75% increase. The elastic modulus remained unchanged. Scanning electron microscopy observations of the fracture surfaces of the treated specimens showed typical ductile fracture characteristics. The fracture surfaces of the untreated specimens clearly showed brittle characteristics with microcracks, the researchers reported.

In order to understand the underlying mechanism, C.W. Wu in the Department of Mechanical Engineering at Dalian said that the research group performed electron probe microanalysis on the untreated and treated samples. The untreated alloy consists of NiAl, Cr(Mo), and Heusler phases. These do not change when the alloy is heated to 900°C. In the magnetic-field-treated samples, the Heusler phases at the NiAl/Cr(Mo) grain boundaries were partly dissolved into the NiAl and Cr(Mo) phases. In addition, small Heusler phase particles at the Cr(Mo) and matrix phase interfaces partially dissolved into the NiAl matrix (see Figure 1). The researchers speculated that the dissolution of the Heusler phase due to the high-magnetic-field treatment contributed to the improvement in bending strength and ductility of the alloy. The exact mechanism, however, remains unclear.

GOPAL RAO

Metalorganic Building Block Enables Synthesis of Four Supramolecular Isomers

While supramolecular isomerism is widely encountered in the field of crystal engineering, the majority of these that have been reported require a co-existence of different guest components for production. An elementary system of supramolecular isomers that has been encountered is the zero-dimensional ring-like, one-dimensional zigzag, and helical chains that can be derived from a stoichiometry of 1:1 metal/ligand molar ratio. Now, X.-M. Chen and colleagues from Sun Yat-Sen University in China have fabricated low-dimensional supramolecular isomerism (chairs, zippers, and chains) of 0D/1D coordination polymers without the use of guest components.

By using a binary Cu^+ triazololate $[\text{Cu}^+(2\text{-Hpytz})_x]$ (2-Hpytz = 3,5-di-(2-pyridyl)-1,2,4-triazololate) pre-designed, metalorganic building block, the researchers isolated four types of air-stable crystals of different colors and/or shapes. Crystallographic studies revealed the stoichiometry of 1:1 (metal/ligand) for all

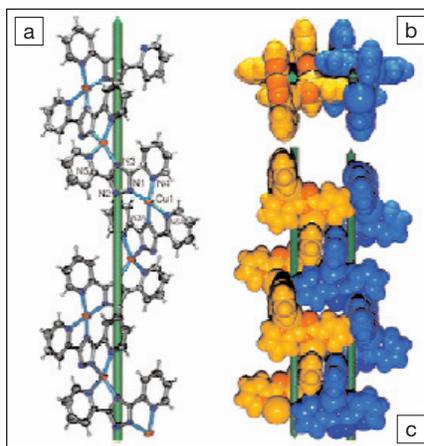


Figure 1. ORTEP drawing (50% A: 0.5 - y, x - 0.5, z - 0.25) of a single 41 helix in Complex IV (a). Top (b) and side (c) views of two adjacent helical chains in space-filling modes. ORTEP stands for Oak Ridge thermal-ellipsoid plot program. Reproduced with permission from *Chemical Communications* (2005), p. 1258; DOI: 10.1039/b416095a. © 2005 Royal Society of Chemistry.

complexes isolated. The researchers' findings were reported in the March 1 issue of *Chemical Communications* (p. 1258; DOI: 10.1039/b416095a).

The different complexes were synthesized based on the different conformations of the coordinating ligands. Complex I was a red polyhedral crystal that possessed a centrosymmetrical, chair-like tetrameric superstructure. The researchers attributed this superstructure to the *cis-cis* and *cis-trans* 2-Hpytz ligand conformations. Complex II (with the conformation of Hpytz ligand, *cis-trans*, and half a *cis-cis*) was a red column crystal that has a highly distorted tetrahedral environment that produced a zipper-like double-chain superstructure. Complex III (with the conformation of pytz ligand, one *cis-trans*, and a distorted tetrahedral Cu^+ metal center) was an orange column crystal that is centrosymmetric, which gave rise to anti-parallel, aligned, polar zigzag chains, the researchers said.

Complex IV (see Figure 1) was an orange needle-like crystal that gave rise to a homochiral structure with an anti-parallel, aligned, single-stranded 4_1 helix, which is rare, the researchers said. This complex was synthesized by varying the reaction times and conditions. The researchers said that this system represents the first example of low-dimensional, supramolecular isomerism in coordination polymers and gives rise to controlled crystallization of individual isomers.

LARKEN E. EULISS

Wavelength Multiplexing of Microsphere Resonators Used to Characterize Nanolayers

Biosensors are widely used in clinical and military applications as well as for the characterization of biomolecular interactions important in drug discovery. While traditional optics employ nanolayers made from inorganic insulators, semiconductors, and metals, the emerging field of biophotonics employs DNA, proteins, lipids, and hydrogels in soft condensed biofunctional layers formed at aqueous-solid interfaces. Recently, S. Arnold and co-researchers from Polytechnic University in New York have developed a non-invasive method to optically characterize bioactive nanolayers formed *in situ* on a silica microsphere.

As reported in the March 1 issue of *Optics Letters* (p. 510), the research team developed an appropriate theory, validated it experimentally, and then demonstrated their method's utility by optically characterizing a biophysically relevant hydrogel. Focusing on the theoretical effect that a nanolayer has on a microsphere's whispering-gallery modes (WGMs), the researchers applied perturbation theory to transform the electric-field equations for the transverse electric WGMs to make the problem analogous to the solution of the Schrödinger equation with an appropriate effective potential. The optical transmission spectra of the WGMs have resonances that are perturbed by the addition of nanolayers of material. By judiciously choosing two wavelengths, λ_1 and λ_2 (760 nm and 1310 nm, respectively), the researchers found that the ratio S of the fractional shifts in the resonances of the WGM wavelengths has the limit of λ_1/λ_2 (0.58, in this case) for a thick layer and a limit approaching unity for an ultrathin layer. In addition, using two equations derived by the researchers, both the layer thickness and the optical dielectric constant can be independently determined from the measurements of the wavelength shifts of the WGMs.

The researchers conducted two experiments to test these limits. In the first, as a monolayer of bovine serum albumin (~3 nm thick) was formed on a silica microsphere, monitoring of the resonances associated with the two wavelengths showed that each shifted about the same amount, $S = 1$, consistent with the theory for a thin layer on the microsphere. In the second test case, the researchers injected NaCl into the water surrounding a microsphere and incrementally increased the salt concentration by 0.1 M. A plot of the resonance shift at λ_1 versus the resonance shift of λ_2 displayed a slope of 0.54, consistent with that predicted for the for-

mation of a thick layer around the microsphere. The researchers said that both limiting tests agree reasonably with theory.

The researchers then characterized a nanolayer composed of poly-L-lysine hydrogel, which, due to its very high charge, readily adsorbs negatively charged biomolecules. Poly-L-lysine hydrogel nanolayers are also difficult to characterize using other methods because it forms such thin layers with low contrast to water. The researchers observed a very small resonance shift, which their theory indicates corresponds to a layer thickness of 110 nm and an excess refractive index of 0.0012. The researchers said that as a result of their method, "the WGM resonator goes beyond its original promise as a biosensor." In addition, the researchers anticipate that real-time measurement of *S* will reveal morphology changes concomitant with increases in layer density. Furthermore, Arnold and his co-researchers said that an alternate formulation of their theory applied to nonspherical particles "shows promise for looking at heterogeneous structures such as adsorbed bacteria."

STEVEN TROHALAKI

Metalorganic Gel Used for Porous Organic Polymer Template

Coordination polymers where metal centers are linked by organic bridging ligands represent novel materials with potentially useful porosity and inclusion properties. Much of the research on this class of materials has, however, focused on studying single crystals of these materials to understand the molecular basis for their formation and properties. Polymer gels—which potentially have interesting properties in catalysis, sensing, and as responsive materials—have been far less studied. In the March 28 issue of *Chemical Communications* (DOI: 10.1039/b418554d), Q. Wei and S.L. James from the Queen's University of Belfast in Northern Ireland report the reaction of iron nitrate and 1,3,5-benzenetricarboxylic acid in ethanol to give a metal-organic gel with a solvent content of 95–98% by weight.

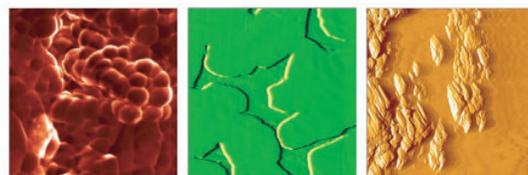
The researchers propose that coordination polymer particles are formed by rapid cross-linking polymerization between Fe^{3+} and the benzenetricarboxylic acid and that these particles are further cross-linked to provide macropores that trap solvent molecules. The gel can be formed in the presence of organic monomers, which can be trapped in the cavities and polymerized to form porous imprints of the metalorganic gel. Wei and James demonstrate this for poly(methyl methacrylate) (PMMA) by polymerizing methyl methacrylate in the gel cavities and dissolving the gel framework in hydrochloric acid. The resulting PMMA imprint contains disordered pores with a size range of 1–10 μm .

James said that the major advantage of this technique is that it is a straightforward and inexpensive route to templating porous organic polymers, which have potential applications in supports and separations. The presence of metalorganic particles within the polymer matrix suggests that other interesting magnetic and responsive properties may be observable in these materials, the researchers said.

SARBAJIT BANERJEE

Tungsten Nanoparticles Embedded in Silica Enhance Nonvolatile Memory

Many consumer electronic products use nonvolatile memory devices in their operation. One such device is electrically erasable and programmable read-only memory (EEPROM), which uses a floating gate structure. In the drive to develop memories with lower power consumption and faster erase/write cycles, researchers have begun to incorporate nanocrystals into their EEPROMs in order to improve performance. Recently, T.C. Chang of the National Sun Yat-Sen University, P.T. Liu of the National Chiao Tung University, and their colleagues demonstrated that replacing the floating gate in EEPROMs with tungsten nanocrystals in a silica matrix reduces the operating voltage and increases endurance. Using nanoparticles in



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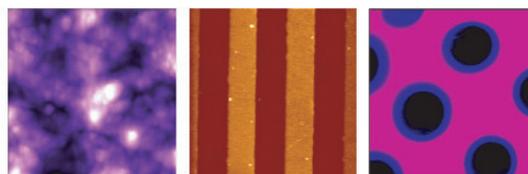
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the floating gate makes the structure more tolerant to defects in the tunnel oxide and therefore reduces leakage. This permits the use of thinner tunnel oxides, which in turn reduces the operating voltage, improves endurance and retention, and increases the write/erase rate.

To fabricate their devices, the researchers took advantage of the fact that tungsten silicide on SiO₂ forms elemental tungsten when thermally oxidized. As described in the March issue of *Electrochemical and Solid-State Letters* (p. G71), the team began by growing a 4.5 nm tunnel oxide on silicon substrates, followed by sputter deposition of 8 nm of W₅Si₃ for the floating gate and 10 nm of amorphous silicon. A thermal oxidation step formed the control oxide and the elemental W in the SiO₂ matrix. The W particles had an average diameter of 4.5 nm and an areal density of 3.7×10^{11} cm⁻². Fourier transform infrared spectroscopy analysis showed that elemental tungsten was clearly present, with little or no tungsten oxide formation.

The researchers used capacitance–voltage measurements to demonstrate the electron charging effect of their W particles. A bidirectional voltage sweep from 3 V to –4 V and back to 3 V yielded a shift in the threshold voltage ΔV_t of 0.95 V, which is sufficient for binary switching. The researchers found that there was no appreciable decrease in ΔV_t until after 10⁶ cycles and in fact, after 10⁹ cycles, ΔV_t had only dropped to 0.71 V.

The operating characteristics of the W nanoparticle EEPROMs represent an improvement over both the high 7 V operating voltage of conventional floating gate devices and the rapid drop-off seen in the endurance of other nanoparticle devices. In addition, this silicide technique is easily integrated with existing semiconductor technology, making the W nanocrystal devices viable competitors to conventional EEPROMs.

AMANDA GIERMANN

Transparent Hydroxyapatite with High Crystal Orientation Produced by Pulsed Electric Current Sintering

Hydroxyapatite [Ca₁₀(PO₄)₆(OH), HAp] is a major mineral component found in bones and teeth. As a biomaterial, it aids the growth and development of bones and teeth by providing attachment sites for new cells. HAp has a hexagonal crystal structure and there is a large difference in cell attachment between the *a* plane and the *c* plane. Sintered dense HAp bodies with a high degree of crystal orientation are useful for culturing cells and as scaffolds for the regeneration of bones and teeth.

In the January issue of the *Journal of American Ceramic Society* (p. 243; DOI: 10.1111/j.1551-2916.2004.00041.x), researchers Yujiro Watanabe of Hosei University, Japan, and Toshiyuki Ikoma of the National Institute for Materials Science, Japan, and colleagues reported a sintering process for producing dense, transparent, and highly oriented crystalline HAp bodies.

The researchers first prepared the HAp powder by reacting Ca(OH)₂ with H₃PO₄ solution, followed by spray drying and then calcining at 800°C for 3 h. Sintering of the HAp sample was carried out by pulsed electric current sintering (PECS) in a spark plasma sintering (SPS) system. In the PECS process, powder particles are charged with electrical energy and a high pressure is applied on the sample.

During the sintering of HAp, the sample was pressed uniaxially at 50 MPa in vacuum. The sintering temperature was elevated at a rate of 50°C/min to 1200°C. After maintaining the temperature for 10 min, the sample was slowly cooled to 600°C at a rate of 5°C/min. The electric current was then stopped, the pressure was released, and the sample was cooled to room temperature.

The resulting bulk sample has high optical transmittance at wavelengths above 700 nm to at least 1100 nm (i.e., >70% for a 1-mm-thick sample), and a density >99.7% of the theoretical value. As for the crystal orientation, the researchers concluded from x-ray diffraction measurements taken perpendicular and parallel to the direction of the pressure that there is a very significant crystal orientation on the *a*, *b*, and *c* planes. The *c* plane is aligned parallel to the pressure direction, while the *a* and *b* planes are aligned perpendicular to the pressure direction. Orientation indexes of the *a* and *b* planes are much higher than those of samples obtained with other processes.

SHIMING WU

LaPO₄:Eu³⁺ Nanowires Luminesce More Efficiently than Dots

One-dimensional LaPO₄:Eu³⁺ nanowires luminesce more efficiently than zero-dimensional, spherical LaPO₄:Eu³⁺ nanoparticles, said Hongwei Song and co-workers from the Chinese Academy of Sciences. As reported in the March 1 issue of *Optics Letters* (p. 483), the researchers studied the luminescent properties of low-dimensional LaPO₄ doped with rare-earth Eu in order to better understand the fundamental physics of this new condensed-matter system. With the technological drive toward smaller and novel devices, LaPO₄ is

appropriately studied as it is used in fluorescent lamps, cathode ray tubes, and plasma display panels.

The research team reported that the Eu atoms partially filled *f* orbitals, which carry magnetic moments. In addition, Eu³⁺ ions are sensitive activators for use in the study of local symmetry. The researchers used this property of Eu³⁺ to study the structural differences between nanowires, nanoparticles, micron-sized powders, and micron-sized rods.

The LaPO₄:Eu nanowires, nanoparticles, micropowders, and microrods were prepared by a wet chemical method. The colloidal nanoparticles and micropowders were basic and the nanowires and microrods were acid. The diameter of the nanoparticles and nanowires ranged from 10–20 nm, whereas the length of nanowires ranged by several hundred nanometers. The diameters of micropowders ranged over 1–2 μm. The diameters and lengths of the microrods were ~200 nm and 1–2 μm, respectively. X-ray diffraction patterns revealed that the crystal structures of all of the samples belong to the monoclinic monazite type. Time-resolved emission spectra and high-resolution transmission electron micrograph images show that the Eu³⁺ ions occupy two sites in the nanowires as well as the microrods, but not in the nanoparticles or the micropowders. The researchers attributed this result to a degeneration of the crystal field in the micropowders. They also concluded that the observed higher radiative rate for nanowires, as compared with the nanoparticles, micropowders, and microrods, was due to the “variation of the electronic–magnetic dipole field caused by shape anisotropy.”

VIVEK RANJAN

Raman Measurements in Silicon Nanowires Reveal the Diameter Dependence of Phonon Confinement

Phonon confinement in a small nanosystem leads to an asymmetric broadening of the Raman bands. Recently, P.C. Eklund from the Pennsylvania State University, G.U. Sumanasekera from the University of Louisville, and their co-workers determined the evolution of phonon confinement with wire diameter of long, crystalline Si nanowires using the Raman microprobe method.

As reported in the March 1 issue of *Nano-Letters* (p. 409; DOI: 10.1021/nl0486259), the researchers prepared Si nanowires by pulsed Nd:YAG laser vaporization of a Si target containing ~10 at.% Fe. The wire growth process occurs through the vapor–liquid–solid mechanism in which a

Fe/Si nanoparticle acts as a “seed” and the Si filaments grow from the Fe/Si nanoparticle surface. This approach produced wires with a distribution of diameters ranging from 8–40 nm. In order to produce smaller-diameter wires, the researchers developed a post-synthesis approach. They used oxidation at elevated temperature to diffuse oxygen radially inward and shrink the Si crystalline core. Fractions were then separated according to the wire diameter using centrifugal separation. Using this method, the researchers produced a series of four crystalline Si nanowire samples whose most probable diameters were 4.5 ± 0.2 nm, 6.5 ± 0.3 nm, 9.5 ± 0.3 nm, and 23.1 ± 0.7 nm. The researchers probed the phonon bands in these nanowires using Raman spectroscopy at low enough laser intensity that temperature broadening was not a factor. Comparison of the Raman spectra of these Si nanowires showed that with decreasing diameter, the first-order Raman band at ~ 520 cm^{-1} develops a noticeable asymmetry to lower frequency, and the peak position downshifts.

The researchers analyzed their results based on an asymmetric line-shape model developed by Richter with an adjustable parameter (α) added to the theory that defines the width of the Gaussian phonon-confinement function. The researchers found that this parameter is not sensitive to diameter over the 4–25 nm range if they took into account the measured diameter distribution. This result is contradictory to the large range of reported α values. While attributing the difference to a variety of unknown conditions, the researchers said that the thickness and nature of the oxide coating on the wire might also impact the phonon confinement. That is, they said, the phonon in the crystalline core of the nanowire has to decay into phonons in the oxide shell. Therefore, the researchers suggested future experiments on hydrogen-terminated Si nanowires to see how hydrogen termination affects the value of the confinement parameter.

TAO XU

Bulk Metallic Glass Foam Achieves High Ductility

Metallic foams are currently used as ultralight structural materials. Bulk metallic glasses (BMGs) show exceptional strength and elasticity, in addition to other favorable properties, rendering them also useful for structural applications and potentially for biocompatible implants. A.H. Brothers and D.C. Dunand of Northwestern University considered, then, whether BMG foams offer unique opportunities in engineering structures or bio-

medical implants. They have found that Vit106 ($\text{Zr}_{57}\text{Nb}_5\text{Cu}_{15.4}\text{Ni}_{12.6}\text{Al}_{10}$) foam shows compressive properties not unlike ductile aluminum foam, despite a lack of ductility in monolithic Vit106. Furthermore, Vit106 contains neither precious metals nor toxic beryllium, and shows biocompatibility.

As reported in the February 18 issue of *Advanced Materials* (p. 484, DOI: 10.1002/adma.200400897), the researchers produced samples by crushing optical-grade BaF_2 and sieving it to produce and select 215–220 μm particles. These were then packed into graphite crucibles and sintered at 1250°C for 10 h under high vacuum. The 7-mm-diameter patterns were then placed in stainless steel crucibles and vacuum-dried at 300°C for 30 min. Vit106 charges were then combined with the BaF_2

patterns in preheated crucibles and melted. High-pressure argon gas was applied to the Vit106 surface to drive it into the BaF_2 pattern. After cooling, the Vit106/ BaF_2 composite was ground to a desired size and the BaF_2 was leached out using nitric acid. Scanning electron microscope images of Vit106 foams of 4.5 mm diameter and 8.7 mm height show 78% open porosity with pore sizes of 212–250 μm . The thickness of all Vit106 struts is well below 1 mm, where high bending ductility is expected. X-ray diffraction shows that no crystalline phases were present in the foam. The researchers concluded that BMG foams can achieve high compressive ductility through strut bending, in sharp contrast to the brittle compressive behavior of BMG in monolithic form.

VIVEK RANJAN

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Corrections

MRS Bulletin misprinted the sponsors of Symposium LL in the report on the 2004 Materials Research Society Fall Meeting (*MRS Bulletin* 30 [3] [March 2005] p. 239). Support to Symposium LL was given by the Army Research Office (United States of America) and the Engineering and Physical Sciences Research Council (United Kingdom). Following is the corrected report.

Materials Issues in Solid Free-Forming

Symposium LL brought together discussions addressing important issues related to free-forming and other parallel processing methods for advanced materials. The symposium opened with a special address titled “Electrospraying Wings of Molecular Elephants” by John Fenn (Virginia Commonwealth Univ.), 2002 Nobel Laureate in Chemistry. The presentation elucidated the electrospray technique and the significant advantage in the use for weighing large biomolecules. Several sessions followed, with invited papers from a host of eminent scientists from around the world. The first session covered the broad field of solid free-forming, with M. Edirisinghe (Queen Mary, Univ. of London), B. Derby (Univ. of Manchester and UMIST), A. Safari (Rutgers), and L. Iuliano (Politecnico di Torino) presenting talks on jet-based and other advanced materials-forming methods at both the nano- and micrometer scales. The following session covered 3D fabrication and applications (J. Beaman, Univ. of Texas; E. Sachs, MIT; Y. Gogotsi et al., Drexel). The second day started with a session on processing and fabrication of advanced materials (G. Babini and L. Settineri, Politecnico di Torino). The final session addressed electrohydrodynamic atomization and applications (J. De la Mora, Yale; K.L. Choy, Univ. of Nottingham; M. Brenner, Harvard, and I. Loscertales, Univ. of Malaga).

Symposium Support: Army Research Office (United States of America) and the Engineering and Physical Sciences Research Council (United Kingdom).



Nobel Laureate John Fenn (left) with Suwan Jayasinghe, lead symposium organizer.

News of MRS Members/Materials Researchers

Dan David Prize Recognizes Materials Scientists' Impact on the Future

This year, the Dan David Prize has given a \$1 million award for achievements in materials science, recognizing researchers' outstanding scientific impact on the future.

Headquartered at Tel Aviv University, Israel, the Dan David Prize annually awards three prizes for achievements having an outstanding scientific, technological, cultural, or social impact on the world. Each year, one field is chosen for each of three time dimensions—past, present, and future. The laureates for a given year are chosen from these fields.

For 2005, materials science was chosen to represent the future time dimension. Following a meeting of its distinguished Board at the University of La Sorbonne in Paris, the Dan David Prize announced three award recipients in this area: **Robert Langer** (Massachusetts Institute of Technology, USA) for having pioneered the development of tissue engineering and the creation of numer-

ous novel biomaterials; **C.N.R. Rao** (Jawaharlal Nehru Centre, India), for his sustained record of scientific accomplishments in solid-state and materials chemistry; and **George Whitesides** (Harvard University, USA) for having bridged the fields of chemistry, chemical engineering, and biology to new heights through the development of novel functional materials and systems.

To foster the next generation of scholars, each laureate is to donate \$15,000 as a scholarship to an outstanding doctoral candidate in materials science.

The awards will be presented at a ceremony to be held on May 23, 2005, at Tel Aviv University. The prize, established in 2001 and named after international businessman and philanthropist



Robert Langer



C.N.R. Rao



George Whitesides

Dan David, is funded by the Dan David Foundation. David, inventor of automatic photo booths, is president of Photo Me International.

The Dan David Prize recognizes work in different fields each year. On the announcement of the 2005 recipients, David said, "This year, the winners of the Dan David Prize once again demonstrate exceptional accomplishment... In the field of materials science, the Dan David Prize has recognized the exceptional contribution of scientists whose pioneering research offers a brighter future."

L'Oréal-UNESCO Award Promotes Women of Materials Science

The L'Oréal-UNESCO for Women in Science Award has awarded \$100,000 prizes to each of five materials scientists from five continents—Africa, Asia-Pacific, Europe, Latin America, and North America. According to the L'Oréal-UNESCO partnership, the contribution of women in science is under-represented. One of the ambitions of the L'Oréal-UNESCO Awards is to help bridge this gap and bring international recognition to these exceptional scientists.

The 2005 awards go to **Zohra Ben Lakhdar** (University of Tunis, Tunisia), "for her experiments and models in infrared light spectroscopy and its applications to pollution detection and medicine"; **Belita Koiller** (Federal University of Rio de Janeiro, Brazil), "for her innovative theoretical research on electrons in disordered materials such as glass"; **Dominique Langevin** (University of Paris-Sud, France), "for her fundamental investigations of detergents, emulsions, and foams"; **Myriam P. Sarachik** (City College of New York, USA), "for important experiments on electrical conduction and the transition between metals and insulators"; and **Fumiko Yonezawa** (Keio University, Japan), "for her pioneering theory and computer simulations of amorphous

semiconductors and liquid-metals."

The L'Oréal-UNESCO fellowship program, founded to encourage young women researchers in the life sciences, also branched out to other fields this year. Among the 15 fellows named is polymer scientist **Ketsiri Kueseng** (Walailak University, Thailand), for her work on the water and oil-repellency of Thai silk. Kueseng has been reported missing since the tsunami of December 2004.

The awards were presented to the L'Oréal-UNESCO laureates on March 3 by Koïchiro Matsuura, UNESCO director-general, and Lindsay Owen-Jones, chair and CEO of L'Oréal. Nicole Ameline, French minister for parity and equality in the workplace, participated in the ceremony in her capacity as president of the Honorary Committee.

Pierre-Gilles de Gennes, 1991 Nobel Laureate in physics, presided over the evening's events in the presence of the members of the international jury and Christian de Duve, founding president of the awards and 1974 Nobel Laureate in medicine.



Zohra Ben Lakhdar



Belita Koiller



Dominique Langevin



Myriam P. Sarachik



Fumiko Yonezawa

"I am interested by materials science," said de Gennes, "because this field does more than respond to a need; it creates new possibilities and, in terms of changing people's lives, it is an essential discipline."

The L'Oréal-UNESCO for Women in Science Awards, created in 1998, recognize the work of materials scientists for the first time this year and will continue to recognize materials scientists every two years. □