Stephen J. Pennycook to receive MRS Innovation in Materials Characterization Award

Stephen J. Pennycook, a Corporate Fellow of Oak Ridge National Laboratory (ORNL) with a joint faculty appointment at the University of Tennessee–Knoxville, has been honored with the Materials Research Society Innovation in Materials Characterization Award for his "pioneering applications of aberration-corrected *Z*-contrast scanning transmission electron microscopy in the characterization of materials at the atomic scale." He will present an award talk at the 2012 Materials Research Society Spring Meeting in San Francisco. The award has been endowed by Toh-Ming Lu and Gwo-Ching Wang.

In 1992, Pennycook received the MRS Medal for his development of *Z*-contrast imaging in the scanning transmission electron microscope (STEM) which enabled direct determination of the atomic-scale structure and chemistry of materials. Pennycook has since pioneered the rapid expansion of aberration-corrected STEM to materials research from catalysis to structural materials, spintronics and optoelectronics, and nanoscience.

In the area of superconductivity, for example, where it had been known that Ca doping improved the grain-boundary critical current in YBCO, the mechanism was thought to involve substitution of Ca for Y at the boundary. However, TEM imaging and spectroscopy showed that Ca occupies a variety of sites around the boundary, normally associated with Y, Ba, or Cu solute. Theory showed this reduced the strain, and the strain reduction allowed O to return, improving the performance.

More recently, Pennycook and his colleagues identified individual light atoms in monolayer boron nitride (BN) and graphene. In an example where they imaged C and O impurities in monolayer BN, they showed that the O atoms always occupy the N sites, whereas the C atoms always substitute for a BN pair. Pennycook and his group demonstrated that annular dark-field imaging in an aberration-corrected STEM optimized for low voltage operation can resolve and identify all individual atoms in non-periodic solids, advancing the field of materials analysis.

Pennycook holds BA, MA, and PhD degrees from the University of Cambridge, UK. He recently became Fellow of MRS and was awarded the Thomas Young Medal of the Institute of Physics, and the Hsun Lee Award of the Chinese Academy of Sciences. He is co-editor of the book *Scanning Transmission Electron Microscopy: Imaging and Analysis* (Springer, 2011) and served as co-Guest Editor of the January 2012 issue of *MRS Bulletin.* He has over 350 journal publications, 31 book chapters, three encyclopedia articles, and one patent.

Kristi S. Anseth receives inaugural Mid-Career Researcher Award for biomaterials

The Materials Research Society has named Tisone Professor, Associate Professor of Surgery, and Howard Hughes Medical Institute Investigator Kristi S. Anseth of the University of Colorado–Boulder to receive the inaugural Mid-Career Researcher Award for her "exceptional achievement at the interface of materials and biology enabling new, functional biomaterials that answer fundamental questions in biology and yield advances in regenerative medicine, stem-cell differentiation, and cancer treatment." Anseth will be recognized during the awards ceremony at the 2012 MRS Spring Meeting in San Francisco. The Mid-Career Researcher Award, endowed by Aldrich Materials Science, recognizes exceptional achievements in materials research by mid-career professionals.

Anseth is a leading researcher and inventor in the fields of biomaterials and regenerative medicine. She has shown how control of the chemical, biological, and physical properties of biomaterials enables one to probe fundamental cell biology questions and use this information in targeted applications in tissue regeneration. Her approach is unique in that she combines the ability to synthesize polymers with highly defined structures with an understanding of the molecular dynamics of processes at

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the cell–biomaterial interface. Her seminal work on the mechanisms of how extracellular cues are transmitted through cells and her innovative approaches for biomolecule presentation have revolutionized the field. Anseth is widely recognized for blending modern molecular and cellular biology with engineering and quantitative methods to generate the next generation of biomaterials for cell culture, delivery, and tissue regeneration.

Most recently, Anseth has focused on creating new biofunctionalized hydrogel materials using click chemistry. She has applied novel hydrogels to engineer stem-cell differentiation, craniofacial regeneration, pancreatic cell encapsulation, modulation of inflammation, protein delivery, and heart valve repair. She has demonstrated how photodegradable gels that allow real-time manipulation of materials properties or chemistry can provide dynamic environments to answer fundamental questions about materials regulation of live cell function. This ability can affect an array of applications from design of drug delivery vehicles to tissue engineering systems.

Anseth's contributions have been translated into a number of medical products, and she has started two startup companies on biomaterials and tissue engineering.

Following her research fellowship at the Massachusetts Institute of Technology, Anseth joined the University of Colorado in 1996. Among her many honors are election to the National Academy of Engineering and to the Institute of Medicine of the National Academies, selection as the first engineer to become a Howard Hughes Investigator, and recognition by the American Institute of Chemical Engineers as "one of the 100 engineers of the modern era." Anseth is a Fellow of MRS, she received the MRS Outstanding Young Investigator award, and she has served the Society as a member of the Board of Directors, chair of the Planning Committee, and co-chair of the 2009 MRS Fall Meeting. She received her PhD degree from the University of Colorado in 1994. She holds 17 patents and has published over 220 papers.

Markus J. Buehler named 2012 MRS Outstanding Young Investigator for computational modeling

Markus J. Buehler, associate professor at the Massachusetts Institute of Technology (MIT), has been named the 2012 Materials Research Society Outstanding Young Investigator. Buehler was cited for "highly innovative and creative work in computational modeling of biological, bioinspired and synthetic materials, revealing how weakness is turned into strength through hierarchical material design." He will deliver an award talk at the 2012 Materials Research Society Spring Meeting in San Francisco.

Buehler has made profound contributions by bridging disciplines to explain the mechanical properties of structural biological materials in both normal physiological and disease states using an innovative bottom-up approach that combines simulation with experiment. Through research rooted in atomistic-level multiscale models of materials, Buehler has identified the core principles that link the fundamental atomistic-scale chemical structures to functional, engineering scales by understanding how biological materials achieve superior mechanical properties through the formation of hierarchical structures by merging structure and material concepts. He has demonstrated that the way components are connected at distinct scales defines what functional materials properties can be achieved, how they can be altered to meet functional requirements, and how they fail in disease states and under extreme conditions.

Moreover, Buehler's work is extradisciplinary. For example, he discovered through an application of category theory that a striking similarity exists between the structure and function of protein materials, music, language, and social networks, by identifying universal principles of generating heightened functionality despite intrinsic limitations of building blocks. He uses computational methods to shed light on key questions that cannot be addressed through experiments due to lack of resolution, condition control, or other limitations.

By focusing on the link between the atomistic, the meso-, and the macroscale, his work has furthered the understanding of the mechanisms of injury and disease by probing how structural changes (e.g., genetic mutations and other molecular defects) alter materials properties, and by providing a materials science foundation to disease mechanisms (e.g., brittle bone disease). His approach enables the investigation of different biological and synthetic materials with the same technique and without reliance on empirical efforts.

Buehler received his Dr. rer. nat. (PhD equivalent) degree in 2004 from the Max Planck Institute for Metals Research at the University of Stuttgart, Germany, and joined MIT in 2005 after a postdoctoral scholarship at the California Institute of Technology. Since 2010, he has been serving as director of the MIT-Germany Program and as group leader of the Mechanics and Materials Division in Civil and Environmental

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