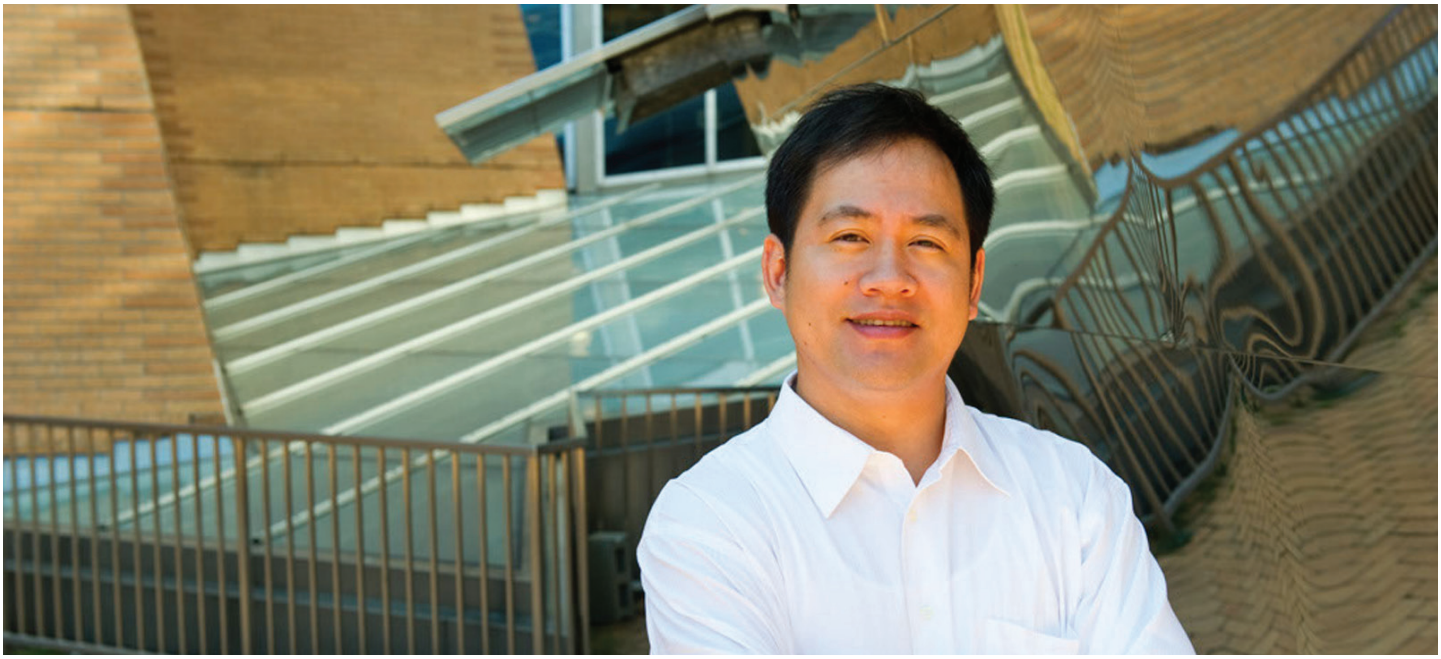
SPOTLIGHT ON **NEW FACULTY IN NUCLEAR SCIENCE AND ENGINEERING**

Ju Li: Atomic insights for new materials development



Nuclear engineering and materials science are distinct but related fields. Newly appointed BEA Professor of Nuclear Science and Engineering Ju Li will straddle the two, as he applies his groundbreaking research into atomic-scale materials behavior to a broad range of challenges, including energy storage, waste management, and reactor materials.

To a large degree, says Ju Li, the difference between his scientific and engineering efforts comes down to time scales.

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"My work involves theory and modeling of materials behavior under high mechanical stress and sometimes high temperatures," he explains. "When you work at the scale of atoms and electrons, you think in terms of picoseconds and femtoseconds. But for engineering systems, you need to predict behavior over years, or even thousands of years for nuclear waste treatment. My primary interest is in extending the time scale of our physical models to the engineering scale."

Over the last decade, Li has established himself as a leader in developing and applying computer simulations to gain greater understanding of fundamental nano-scale mechanical and transport properties of materials. His pioneering cross-disciplinary work has coupled continuum mechanics (in which materials are modeled as continuous masses rather than discrete particles) with meso- and atomic-scale dynamics, and has had a broad impact on the understanding of how materials behave under extreme conditions.

These scientific achievements have helped create a clearer sense of how microstructures evolve over time when exposed to stress, heat, and radiation, and have led to fundamental advances for a range of engineering challenges. These include development of new structural materials for fission and fusion reactors, better-performing battery electrodes, and improved fuel cell components. Other applications have included aerospace materials, as well as the process of vitrifying nuclear waste into a stable glass matrix.

In addition to his appointment in NSE, Li will hold a joint appointment in the Department of

Written by Peter Dunn
Photo by Justin Knight

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Materials Science and Engineering, and will teach in both departments. He will be a key contributor to a variety of new and existing interdisciplinary materials research activities across the Institute.

After receiving his bachelor's degree in physics at the University of Science and Technology of China in 1994, Li came to MIT and earned his Ph.D. in Nuclear Engineering in 2000.

He has since held materials-related faculty positions at Ohio State University and the University of Pennsylvania, and has won many awards, including the Robert Lansing Hardy Award from the Minerals, Metals and Materials Society in 2009 and the Outstanding Young Investigator Award of the Materials Research Society (he is the first to receive this award for theory and simulation rather than experimental contributions). Li was also recently named a Chang Jiang Scholar by China's Ministry of Education.

"Ju's highly interdisciplinary approach to research is especially well-suited to MIT," says NSE department head Richard Lester. "He will powerfully strengthen the intellectual ties between NSE and other School of Engineering departments, and his exceptional creativity, intellectual breadth, and productivity will help ensure a leadership role for the School in extreme materials research for energy and other applications."

Li is looking forward to returning to the Institute and its intellectual climate. "There's so much going on at MIT; everybody is doing very exciting research," he says. "That's the main draw for me."