News Briefs
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Long-Term Effects of Impurities on Luminescent Carbon Dots

Professor O’Carroll’s cover article highlights the role of fluorescent impurities on carbon dot stability.

Carbon dots are fluorescent particles that have attracted significant interest for applications ranging from display and biomarking, as they are biocompatible and can be synthesized from natural products. Javed and O’Carroll recently reported in Nanoscale Advances on their study of the long-term impact of fluorescent impurities on the stability of the physical and optical properties of nanoscale carbon dots. A significant increase in the size of the particles is observed as a function of time after synthesis, and the quantum yield of blue fluorescence, which is mostly caused by impurities that contain carboxyl groups, gradually decays from 30% to ∼3% over 13 weeks. The reduction in quantum yield is attributed to decomposition of impurities that, consequently, deposit on the particles and increase particle size. The blue fluorescence decreases considerably when the carbon dots are properly purified, and a solvent-dependent yellow emission arises. This work highlights the importance of studying and controlling impurities to prepare carbon dots with long-term stability.

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Dr. Akdoğan Promoted to Associate Teaching Professor

Koray’s multi-functional excellence rewarded with a much-deserved promotion.

We are pleased to announce Dr. Akdoğan’s promotion to Associate Teaching Professor upon the recommendation of the MSE faculty, following a favorable unanimous vote. The final approval was issued by Provost and Executive Vice Chancellor for Academic Affairs Professor Francine Conway on 2 February 2021. The promotion will be effective on 1 July 2021. Koray is a teaching and mentoring powerhouse for the MSE department. He is a multiple award-winning teaching faculty, an excellent course developer, an unrelenting recruiter, a devoted mentor of students, and a researcher with a proven track record. We thank him for his service and wish him continuing success in his teaching and academic service, and scholarship.

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Atomistic Behavior at Interfaces

Hydrogen Bonds and Proton Transfer in Water and at Hydrophilic Nanopores

Using advanced molecular simulations, Professor Garofalini’s lab provides the atomistic mechanisms of behavior of solids and liquids at glass surfaces, nanoscale intergranular films, and conversion battery cathode reactions. Their most recent studies address fundamental questions regarding hydrogen bonding, proton transport, and auto-dissociation in bulk water (their 2018 PhysChem/ChemPhys paper was among the journal’s HOT ARTICLES) versus water at hydrophilic surfaces that have applications in a variety of technological areas. For instance, results have enabled them to provide a justification for the otherwise competing interpretations of time-resolved spectroscopies of interfacial behavior with electrochemical studies of proton migration in nanoporous silica.

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MSE Enhances World Class Research Facilities

Professor Haber leads the way with his DoD MIDE funding as a primary source.

The Department has been fortunate to acquire substantial new infrastructure equipment to our already impressive list of materials processing and characterization equipment. Thanks to Professor Haber and his decade-long Army Research Laboratory program “Materials for Extreme Dynamic Environments” an additional $5M in capital equipment has been acquired in recent years. An example of the new facilities is the Malvern Panalytical Empyrean, X-ray diffractometer that is currently being installed in CCR 115. This is a 3rd generation Empyrean with a multipurpose diffractometer with a newly designed MultiCore Optics system to enable the largest variety of measurements without manual intervention. Empyrean has the unique ability to measure all sample types - from powders to thin films, from nanomaterials to solid objects - on a single instrument. The COVID pandemic has delayed the completion of another major facility, the ultrahigh temperature thermal analysis laboratory with three Netzsch systems – a 2400C DTA/TGA, a 2400C laser flash thermal diffusivity system, and a 2800C dilatometer. The
continued enhancement of MSE research facilities will assure continuation of our prominent position among major research universities.

Read more about the CCOMC...

MSE Professor Provides Keynote Lecture to Celebrate 100-years of the Quartz Piezoelectric Oscillator

Ahmad Safari addresses the IEEE - UFFC gathering in remembrance of the accomplishment of Walter Guyton Cady

Professor Safari delivered a keynote address on Advances in Development and Applications of Piezoelectric Materials in the dedication ceremony of the IEEE - UFFC Society Milestone in remembrance of the accomplishment of Walter Guyton Cady. The dedication ceremony took place virtually on November 5, 2020. At right is Professor Safari and the Milestone Plaque at Wesleyan University, Middletown, CT where Walter Guyton Cady did his research.

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Energy Storage Research Group Pushes the Limits of Lithium-Ion Battery Technology

Professor Amatucci’s highly cited work is supported by major funding from, among others, DARPA, DoE, and DoD

Professor Glenn Amatucci’s research group, comprised of faculty, staff, and students—both graduate and undergraduate—continues to push the limits of lithium-ion battery technology. Their work on metal fluorides as lithium-ion battery cathodes recently appeared in Nature Materials. Amatucci’s Scopus h-index is 55 with over 12,300 citations, making him the most cited author in the MSE Department. In the past few years, his team has won a >$1M contract with DARPA to develop microbattery platforms to power autonomous microbots to identify people trapped in collapsed buildings, along with a $1M contract to develop self-assembled batteries for DoD. As the co-founder and associate director of the NorthEast Center for Chemical Energy Storage (NECCES), an Energy Frontier Research Center funded by the US Department of Energy at a level > $24M, he collaborates with researchers at The University of Cambridge, University of Michigan, MIT, Binghamton University, University of California, Berkeley, Santa Barbara, and San Diego, along with Argonne and Brookhaven National Laboratories. This 8-year effort just recently concluded and resulted in significant basic energy storage science and numerous PhDs. Currently his laboratories are performing several projects with government agencies and corporations, as well as several companies in the battery and automotive sectors. As we look towards electric vehicles, personal electronics, and their ever-increasing adoption, it is highly likely that we will be relying on science from Amatucci’s team here at Rutgers.

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Partially discharged m-FeF3 $Li_{0.25}$ A projected potential map solved using charge flipping from an experimental ED pattern recorded parallel to [100].

From: https://doi.org/10.1038/s41563-020-00893-1