Remembering George Crabtree: A luminary in materials science and energy storage

By **Vineeth Venugopal**

George Crabtree left an indelible mark on the scientific community. His passion for science, particularly in the realm of battery and superconductor materials, was not just profound but also transformative. His was a brilliant mind, and whose work not only advanced our understanding of materials science but also inspired a generation of scientists.

A special session at the 2023 MRS Fall Meeting & Exhibit in Boston, Mass., was dedicated to his memory. A video on Crabtree put together by the Materials Research Society (MRS) was first played, followed with an introduction by Y. Shirley Meng from The University of Chicago, who is also the Editor-in-Chief of the journal *MRS Energy and Sustainability*. This session was more than just a commemoration; it was a celebration of George's incredible journey and contributions. His vision was not just about scientific breakthroughs but also about inspiring cooperation among competing institutes. A true believer in the power of collaborative science, George was instrumental in transforming battery research through his work at the Joint Center for Energy Storage Research (JCESR) at Argonne National Laboratory.

Paul K. Kerns, Director of Argonne National Laboratory, reflected on his impact. Kerns spoke of missing George not just as a colleague but as a friend. Under George's guidance, Argonne made significant advances in high-temperature superconductors and research in REDOX and multifilament batteries. George's career at Argonne was remarkable, having first joined as an intern way back in 1964.

George's contributions were wide-ranging. He played a vital role in various committees and workshops, and led Argonne's 2021 initiative in climate change. His dedication to combating climate change was evident in the several town halls he conducted, encouraging distinct research approaches. George's vision in this area continues to inspire scientists who are pursuing ideas he helped create. George's commitment to creating a more inclusive and respectful scientific community was also notable. He co-chaired the Harassment Action Collaborative, focusing on preventing sexual and gender harassment. The JCESR, under his leadership, trained over 300 early-career scientists, creating a legacy of education and mentorship.

George Crabtree.

Sossina M. Haile, a materials scientist and engineer at Northwestern University, highlighted George's influence on her work. Her focus on hydrogen and high-throughput experimental studies of ion transport reflects the scientific rigor and innovation that George championed. She elaborated on the Materials Genome Initiative and the Electrolyte Genome.

The urgency of addressing climate change was a recurring theme in the tributes to George. Linda Nazar from the University of Waterloo discussed multivalent batteries and the challenges of cathode development in Mg^{2+} and Zn^{2+} ion batteries. Her work exemplifies the kind of groundbreaking research that George was passionate about.

Martin L. Green, a former president of MRS and retired from the National Institute of Standards and Technology, recalled George's deep understanding of the role of materials science in addressing global energy crises. He emphasized George's belief in the centrality of materials science in creating a sustainable future, a perspective that is now more relevant than ever as we grapple with the consequences of the industrial revolution and the onset of the Anthropocene.

Kristin Persson of the University of California, Berkeley, who directs the Materials Project, shared a career-defining moment when George invited her to collaborate. Her advancements in electrolyte design, driven by computer simulations for atomic- and molecular-level predictions, are a testament to George's foresight and support for young scientists.

Venkat Srinivasan of Argonne and current director of JCESR discussed the enduring legacies of the Joint Center for Energy Storage Research, highlighting the diversity in battery chemistry and the approach to "bottom-up" battery design. This approach, championed by George, revolutionized the field and led to novel

During the tribute to George Crabtree at the 2023 MRS Fall Meeting in Boston, Mass., Kristin Persson (University of California, Berkeley) presented her advancements in electrolyte design, driven by computer simulations for atomic- and molecular-level predictions.

materials with significant technological impacts.

During the session, discussions were held on advancements in battery technology, particularly focusing on multivalent batteries. Speakers emphasized the importance of cathode, anode, and electrolyte in the development of Mg^{2+} and Zn^{2+} batteries. The concept of eutectic electrolytes and their role in battery efficiency was also explored. The innovative use of inorganic zeolite 3A membranes for anode protection was highlighted, showcasing the ingenious approaches to solving long-standing challenges in battery technology.

The significance of George's contributions to high-temperature superconductors prior to his work with batteries was also elaborated upon, noting how his discoveries pushed the boundaries of what was possible at Argonne. His vision and leadership in overseeing research in areas like REDOX and multifilament batteries were praised, emphasizing his role in shaping the future of energy storage.

In addition to his scientific achievements, George's role as a leader and mentor was a focal point of the tribute. He was celebrated for his dedication to nurturing young talents and fostering a culture of inclusivity and respect within the scientific community. The impact of his co-chairing of the Harassment Action Collaborative was particularly noted, underlining his commitment to making the field more welcoming and safe for everyone.

George Crabtree's impact on the scientific community is immeasurable. His vision, passion, and dedication to materials science and energy research have left a lasting legacy. As we continue to explore the frontiers of science, his vision shines bright, guiding us toward a more sustainable and technologically advanced future. George Crabtree was not just a scientist; he was a luminary in every sense of the term, and his contributions to science will not be forgotten. □