



US and African students unite around materials for sustainable energy at second JUAMI

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The development of solutions to global sustainable energy needs is fraught with challenges. Save scientific and technological considerations, solutions must also overcome geographic, economic, cultural, and communication barriers among researchers across the world. These are not easy tasks, but they are ones that students at the Joint Undertaking for an African Materials Institute (JUAMI) are hoping to address. For 13 days from

May 29 to June 10, 25 US and 40 African students convened at JUAMI 2016 in Arusha, Tanzania, to explore the current state of global sustainable energy research and identify the materials science challenges associated with meeting future sustainable energy needs.

JUAMI was first held in Addis Ababa, Ethiopia, in 2012. This inaugural event established a foundation for international materials science collaboration and

brought together 20 US and 35 African students. The 2016 institute, like the first, had a diverse class of student participants. US students came from more than 15 universities. The African students were predominantly from the sub-Saharan African countries of Tanzania, Kenya, Uganda, and Ethiopia, with representation from Nigeria, South Africa, and Mozambique.

The 2016 institute included an intensive two-week course with lectures, hands-on learning activities, and leading-edge research seminars in the area of renewable energy from top researchers in their respective fields. Every morning, students listened to lectures on topics ranging from batteries and solid-oxide fuel cells to thermoelectrics and polymer photovoltaics. The afternoon learning activities provided students the opportunity to put concepts into practice. Brian Doyle, a doctoral student in Materials Science from Georgia Institute of Technology, appreciated these afternoon sessions: “At times it’s tough to fully grasp physical principles, especially in engineering. Sometimes you just need to see it in person.”

One particular afternoon, teams of students built a galvanostat with common electrical components and a breadboard to measure the performance of a battery. Another afternoon, using similar equipment, photometers were made to test the absorbance of nanoparticles. Doyle said, “The genius in these experiments was the simplicity in which off-the-shelf



Top: JUAMI students test the performance of solar cells in the afternoon Tanzanian sun. Bottom: JUAMI participants visit the Nelson Mandela African Institution of Science and Technology in Arusha, Tanzania, to tour the campus and to attend the institute’s plenary lecture.

supplies were quickly connected to demonstrate a concept in energy materials research.”

Beyond the daily schedule of lectures and activities, JUAMI was an avenue for deep cross-cultural exchange. Simon Billinge, co-organizer of JUAMI and professor of materials science and applied physics at Columbia University, emphasized the personal connections that JUAMI fosters: “Participants are living and working side by side, learning about each other’s challenges and capabilities, and getting to know each other in an East African location.”

Among some of the extracurricular activities, JUAMI participants spent a day together in Tarangire National Park, about 150 kilometers southwest of Arusha, on safari. Students also visited the Nelson Mandela African Institution of Science and Technology (NM-AIST) to tour the campus and laboratory spaces and to attend the institute’s plenary lecture given by Professor Arun Majumdar of Stanford University and former Under Secretary for the US Department of Energy. Majumdar spoke of global energy challenges and the opportunity of developing nations to mold their own energy landscape, relying on renewables and designing and building microgrid systems that are effective and sustainable.

To complete the two-week institute, young researchers in teams of six developed written proposals that address



JUAMI students use a circuit diagram to assemble a galvanostat during an afternoon learning activity.

JUAMI’s long-term goal of growing materials science research in Africa. Proposals covered a wide breadth of topics. One group of students proposed the use of a thermoelectric device attached to a wood-burning stove to convert waste heat into electricity, while another group wished to field-test polymer solar cells under real-world conditions in East Africa. Yet another team’s proposal idea involved the development of a dedicated search engine to facilitate access for African researchers to journal publications. As students move forward from the institute, the hope is that these

proposals and other research collaborations will be carried out across the globe.

JUAMI 2016 was funded primarily by a grant from the US National Science Foundation proposed by Sossina Haile (Northwestern University), Simon Billinge (Columbia University), and Peter Green (University of Michigan). The 2016 institute was co-hosted by NM-AIST in Arusha, Tanzania. The local organizing committee, led by Revocatus Machunda (NM-AIST), worked with US organizers to select student participants and develop the two-week curriculum.

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M-STEM 2016 to be held November 6–8 in the United States
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The Materials in Science, Technology, Engineering and Math Workshop (M-STEM, formerly the National Educators Workshop) 2016 will be held November 6–8, in Tulsa, Okla.

M-STEM brings together students, faculty, and businesses to strengthen understanding of STEM principles, especially relating to materials science, and to enhance K–20 technology education

integration. In addition to oral presentations and posters, the workshop offers opportunities for industry tours, three-day training strands in solids or additive manufacturing, and peer-reviewed publication for current and future reference.

A unique feature of M-STEM is hands-on, interactive learning that engages students and teachers. The workshop offers assistance to instructors

in evaluation and course assessment methods, new materials technologies, roadmaps and methods for development of new materials courses, and direct means for introducing materials concepts into existing courses.

More information can be accessed from the workshop website at www.materialsinstem.org or by email at MatEd@edcc.edu. □

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