

Collaborations between African and non-African institutions enhance materials research

By Matthew Hauwiler

In the quest to tackle grand challenges in energy, biology, electronics, and other areas, industry and academic leaders are building cross-continental research collaborations between African and non-African researchers. Their endeavors, however, face cultural and economic challenges due to an imbalance of available resources. How can we as materials researchers bridge the gap between non-African researchers and underserved researchers in African countries to help push global materials research forward?

Researchers from the Materials Research Society (MRS) and African MRS (AMRS) came together to address this question during the workshop “Enhancing Materials Science Through Research Collaborations Between African and Non-African Institutions” held at the 2024 MRS Spring Meeting & Exhibit in Seattle, Wash., on April 22, 2024. This session, which brought together researchers from across industry and academia, focused on the challenges and opportunities and discussed what they learned from their collaborations.

Sharing materials samples across continents, for example, can encounter technical and logistical barriers. Often, African researchers do not have access to advanced characterization equipment and instruments, and can benefit from collaborations with researchers in Europe, Asia, or North America with access to these tools. Shipping samples requires careful thought on maintaining sample integrity as well as dealing with difficult customs policies. As one solution, workshop speaker and panelist **Jed Pitera** described how IBM uses robotic synthesis machines to generate reproducible materials recipes that can be made at any of IBM’s global research centers.

Pitera is the Strategy Co-Lead in Sustainable Materials at IBM Research. He said IBM started a research laboratory in Nairobi, Kenya, in 2013 and in Johannesburg, South Africa, in 2016 for which 70% of the current researchers at the facilities were from local talent. The sites work on projects including accelerated discovery technologies and artificial intelligence foundations such as modeling to predict natural disasters. The African Research Laboratories have developed a strong presence at IBM, even leading efforts to bring IBM materials research from across the company under one organizational umbrella. IBM Research’s investment in Africa is an example for other technology companies to follow to consider research expansion onto the continent.

Audience participants such as **Tabitha Amollo**, a lecturer in the Department of Physics at Egerton University in Kenya, shared additional examples about the challenges African researchers face without access to necessary equipment. Speaker and panelist **Martin Thuo**, a professor at North Carolina State University, said he had sent equipment to African universities only to see it sitting unused in future visits. He expressed the need to invest in researchers such as Amollo, who can make the most impact with the resources and equipment. Thuo furthermore emphasized prioritization of developing scholars in Africa rather than simply giving resources or equipment. Partnerships with African institutions that focused on advancement and collaboration rather than philanthropy will drive innovation and job creation. Expanding the talent pool benefits both the science community and broader society, Thuo said.

Still, many barriers other than lack of equipment prevent African

researchers from doing research. These include the onerous bureaucracy for researchers in many countries in Africa, from complicated funding processes to demanding teaching loads to extensive PhD requirements. **Mmantsae Diale**, a professor at the University of Pretoria, who served as one of the Meeting chairs for the 2024 MRS Spring Meeting & Exhibit, made the point that African researchers know best how to navigate the local bureaucracy, so outside researchers interested in collaborative projects should communicate with their partners in Africa about how best to implement the collaboration. For example, Thuo was able to negotiate with an African university to have US professors do seminars at the university in exchange for decreasing the teaching load on collaborators, who could use that time to do research.

Tessera Alemneh Wubieneh, an associate professor at Bahir Dar University in Ethiopia, who is researching thermoelectrics and creating new materials for waste heat recovery, also discussed some of the challenges of collaborations from the African side. There are always concerns about not having enough funding, he said. He further revealed other less obvious obstacles such as differences in research culture and a lack of common research language. There also exists a power imbalance in these research collaborations, and this can manifest itself in who gets to claim the first and last authorship when the work is published. These problems along with bureaucracy, management, and teaching loads limit researchers at African institutions from fully engaging in research collaborations. Successful cross-continental partnerships are mutually beneficial, he said. Increased funding and more



Sossina M. Haile, the Walter P. Murphy Professor of Materials Science and Engineering at Northwestern University, provides insights on the Joint Undertaking for an African Materials Institute (JUAMI) program in which African and US graduate students collaborate on materials science research projects.



Nutifafa Doumon, an assistant professor at The Pennsylvania State University and Virginia S. & Philip L. Walker Jr. Faculty Fellow in Materials Science and Engineering, co-founded the company DAMINY EduNergy Ltd, which he started in Ghana, that currently provides a mentorship program for young researchers on the African continent.

equitable partnerships are his recommendations to address the challenges.

Another barrier brought up by audience members was the lack of access to scientific literature due to paywalls. Understanding scientific literature is a skill that takes time and practice to develop. Without access to the literature, African scientists are unable to develop scientific literacy skills and fall behind on the latest scientific advances. Speaker and panelist **Sossina M. Haile**—the Walter P.

Thuo encouraged the audience to look at the opportunities of materials science research in Africa rather than solely the challenges. **Sabrina Sartori**,

conditions to facilitate publication opportunities for common projects or research undertaken with African researchers. He has worked on multiple collaborative materials research projects around sustainable energy with researchers at African institutions, leading to co-authored publications.

Murphy Professor of Materials Science and Engineering at Northwestern University—recommended that African researchers reach out to the authors of articles to share copies at no cost. **Nutifafa Doumon**, an assistant professor at The Pennsylvania State University (Penn State) and Virginia S. & Philip L. Walker Jr. Faculty Fellow in Materials Science and Engineering, who was also a speaker and panelist at the workshop, suggested literature clubs to help develop those valuable literature reading skills.

On the other side of the publication equation, Doumon recommended that audience members from outside Africa leverage invited journal submissions

a professor at the University of Oslo and MRS Immediate Past President, introduced European collaboration efforts with Africa, including the African Research Universities Alliance (ARUA) and The Guild of European Research-Intensive Universities Cluster of Research Excellence in Renewable Energy. A recent joint commitment was made between ARUA and the Mastercard Foundation toward training 1000 PhD candidates in energy and climate science over a 10-year period in Africa, starting in January 2026. She also described the Norwegian UTFORSK program as a source for Norway enhancing educational and research collaboration with Africa, preparing students to address local and global societal challenges.

Vice President of MRS **Eric A. Stach**, the Robert D. Bent Professor of Engineering at the University of Pennsylvania (UPenn), talked about collaborative efforts between the Laboratory for Research on the Structure of Matter at UPenn and universities in South Africa. This laboratory has brought researchers from South Africa to UPenn to work on materials projects over the summers for over two decades. Stach encouraged attendees to share this opportunity with anyone in Africa who may be interested in doing research at UPenn.

Doumon described DAMINY EduNergy Ltd, a company he co-founded and started in Ghana that currently provides under its umbrella the DAMINY EduNergy Mentorship Program (DENMP) for young researchers/scholars on the African continent. DENMP has close to 40 mentors from almost 15 countries in Africa and now residing in 18 countries worldwide. The dream is to eventually build an education and research (materials science) center focusing on four identified pillars: Leadership, Education, Energy (Science), and Research.

Doumon is also a member of the Alliance for Education, Science, Engineering, and Design with Africa (AESEDA) at Penn State, which is actively working on Memorandums of Understanding with African



institutions—such as the University of Ghana in Ghana, Moi University in Kenya, and Mintek in South Africa—for joint research projects. In an AESEDA/Materials Research Institute (MRI)/Africa collaborative effort, African researchers can also get access either directly or via a collaborator to Penn State’s Materials Characterization Laboratory within the MRI.

The Joint Undertaking for an African Materials Institute (JUAMI) is a shining example of an impactful collaboration between the US and African institutions, and Haile provided insights on the JUAMI program structure and lessons learned. JUAMI is a two-week, in-person materials science school for approximately 50 graduate students at US and African universities. Participants receive instruction from leading researchers in the materials field and work in collaborative teams on materials science project proposals. The US National Science Foundation (NSF) has generously supported this program, and there have been four JUAMIs so far—2012 in Addis Ababa, Ethiopia; 2016 in Arusha, Tanzania; 2018 in Kampala, Uganda; and 2023 in Nairobi, Kenya. A variety of exciting projects have come out of JUAMI, leading to published articles and impactful education initiatives. JUAMI has continued to develop and improve from past institutes, and the plan is to continue building US-African collaborations and lifelong friendships through future JUAMIs.

Senior engineer **Matthew Hauwiller** from Seagate Technology talked about the recent virtual Industry Grand Challenge co-hosted by Seagate Technology and COMPASS, an NSF Science and Technology Center. This hack-a-thon style competition posed an industry materials science problem to teams of participants from African universities and COMPASS, and teams had the opportunity to pitch solutions to that problem. The Grand Challenge included skill-building webinars to help participants develop their materials science

skills. Since this was the first time Seagate and COMPASS had hosted an Industry Grand Challenge, there was a significant amount of learning that will improve future iterations of the event. Providing the platform for US and African researchers to invent novel solutions to significant materials challenges is mutually beneficial to participants and the organizations sponsoring the program, Hauwiller said.

The workshop enjoyed significant support from MRS leadership. At the opening of the session, 2024 MRS President **Takao Someya**, a professor at The University of Tokyo, expressed his enthusiasm for collaborative research between African and non-African institutions. He highlighted how Diale from the University of Pretoria was one of the Meeting chairs for the 2024 MRS Spring Meeting & Exhibit, and Winston Tumps Ireeta, an associate professor at Makerere University in Uganda, will be a Meeting chair at the 2024 MRS Fall Meeting & Exhibit in Boston, Mass. MRS has hosted multiple virtual and in-person events between MRS and AMRS and plans to continue increasing joint events between the two societies. The primary goal of this session was to generate interest in the AMRS Meeting in Kigali, Rwanda, which will take place on December 16–19, 2024 (see www.africanmrs.net/rwanda-2024).

Although this session did not make any formal recommendations or action items, a few themes permeated all the presentations and discussions:

- Materials research equipment is needed in Africa, but without coordinating the right users and proper training, donated equipment will go underused. The focus should be on partnering with rising materials science leaders in Africa and then providing them with the resources and equipment to do impactful research.
- Service support for equipment is nonexistent in Africa, so even minor problems can render a tool

permanently unusable. Researchers in Europe, Asia, and North America need to put pressure on equipment manufacturers to hire and train Africans in each part of the continent to be technical service support staff. The cost of these employees would not be exceptional to equipment manufacturers, but the effect on African research would be transformational. African universities and research centers would finally be able to make use of high-end tools like scanning transmission electron microscopes, and equipment manufacturers would also benefit from opening these new markets.

- Research collaborations between continents need to be creative. Much focus is placed on finding financial resources, but there are often ways to provide value to research partners beyond just funding. Researchers should look for opportunities where providing something might cost them little but be extremely valuable for their collaborator.
- Everyone should be encouraged to pursue collaboration at a human level. Building personal relationships is the only way to form true partnerships where everyone benefits and feels valued. Through in-person interactions, researchers can learn about each other’s interests and start to develop long-lasting, mutually beneficial collaborations.

There are tens of thousands of researchers across the world. Materials science discoveries require the synergy of disparate ideas and perspectives, and diverse collaborations with people of different backgrounds, expertise, and experiences can be the fertile ground for innovations to flourish. Participants were strongly encouraged to attend the African MRS Meeting in Kigali, Rwanda, in December 2024, where even more materials research partnerships and innovations can be nurtured.

