



## Under construction: Laying the groundwork for Ethiopia's first materials science graduate program

Ben Pelhan

In Addis Ababa, Ethiopia, cranes and concrete define the landscape. But so do the tin shacks that house both shops and families. They multiply to fill every crevice of the massive city as citizens of Africa's second most populous country migrate from farmland to city center. Many hope the cranes will lift Ethiopia into the prosperity of a middle-income country.

Buildings and public works won't accomplish that alone, however. "We need to utilize our resources to make new materials to improve our lives," says Hagos Tsefay. A chemistry student at Addis Ababa University (AAU), he is also one of the members of the small materials science graduate program.

The University is Ethiopia's oldest, but the program is still young. The first of its kind in the country, it began in 2007

under the direction of Professor Teketel Yohannes Anshebo, who received his own PhD degree from AAU in 1997. It was born at a time when AAU began creating more application-based interdisciplinary programs like food science, biotechnology, and environmental science. Dawit Tebebu, another materials science graduate student, explained the school's motivation when he said, "[Developing] countries must shift from hard sciences to application." The program offers a Master's degree and accepts up to 10 students, but Prof. Teketel foresees bigger things coming soon.

For the first couple of years, the program drew its faculty from departments like chemistry, physics, and mathematics. This met the teaching needs but left students struggling to find advisors with cross-disciplinary expertise. Since then,

AAU began hiring scientists from outside the country who had PhD degrees in materials science to create a core staff for the program under Prof. Teketel's coordination. These staff members could give materials science their full attention.

This has helped the program advance, and Prof. Teketel is looking forward to taking the next steps. He has already begun the university approval process to create a PhD program in materials science. Not only would this mean more dedicated funding from AAU, but it would also enable the program to produce its own faculty.

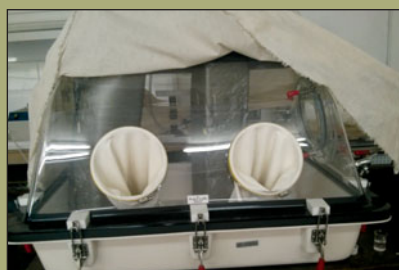
Ethiopian students can look outside the country for a PhD program, and many do. Prof. Teketel knew of about 50 chemistry students who pursued a PhD degree in the United States. He said the problem, however, is that "only two or three of them returned." Without the option to study at home, advanced graduates are much less likely to remain in the country. In turn, this "brain drain" denies Ethiopia one of its most needed resources: an educated workforce.

In fact, Prof. Teketel wasn't always certain that he would end up pursuing his career in his home country either. Luckily though, for AAU and for the



Above: Professor Teketel Yohannes Anshebo. Right: Seven of Prof. Teketel's materials science students (from left to right): Endale Tsegaye, Dawit Tibebu, Hagos Tesfay, Hagos Tuku, Girma Erjabo, Tofik Ahmed, and Fedlu Kedir.





The laboratory for Ethiopia's first materials science program is being set up.

ambitious group of materials science students, he stayed in Ethiopia.

As he was beginning his doctoral studies in 1992, conducting polymers had recently been discovered and many questions were still unanswered. Prof. Teketel's PhD advisor, Prof. Theodor Solomon, took notice of the subject when a University of Nairobi chemist began publishing articles on the topic in *The Bulletin of the Chemical Society of Ethiopia*, and he encouraged Prof. Teketel to focus his research in this area.

With regards to conducting polymers, Prof. Teketel only knew what he had learned from the *Bulletin*. "During those times we didn't have electronic journals like we do now," he said. By chance, he was invited to a multi-week workshop during this time at the International Center for Theoretical Physics (ICTP) in Trieste, Italy. "There they had libraries with all the latest journals," he said, and he wasted no time scouring them for everything he could find on conducting polymers. He made copies and brought reams of research back to Addis Ababa with him. "That was the start."

In retelling his history, Prof. Teketel acknowledged the very real obstacles

to scholars hoping to work at home in Ethiopia. Some graduates don't return because Ethiopia simply lacks the equipment necessary to their field. Some cannot justify giving up better prospects for both salaries and funding, while others simply adopt their country of study as home and no longer feel compelled to return.

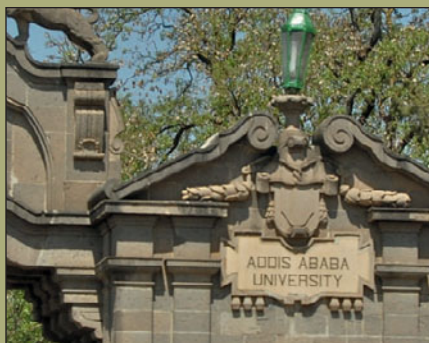
Prof. Teketel said he was lucky enough to marry an entrepreneur, and their combined income made staying put possible when a SIDA-SAREC grant from the Swedish government brought equipment to AAU for the study of conducting polymers-based solar energy conversion. Additionally, his PhD was a "sandwich program," so he spent the second and fourth years of his studies at Linköping University in Sweden and the first, third, and fifth years at AAU. He credits this with keeping him in Ethiopia due to both the ease of being able to stay at home rather than having to return, while also connecting him with international collaborators. To this day, he continues to spend many of his summers abroad, working with researchers in Sweden, Belgium, Italy, Austria, Japan, and China.

Moreover, Prof. Teketel wanted to stay. He wanted to give something to the community that had supported him in his own studies. Satisfied with his ability to contribute both in his field and in his country, he made his home in Ethiopia where he has built not only an impressive resume, but also the foundation of a promising materials science program.

His students are grateful for both. Tofik Ahmed lauded the program for its "rigorous curriculum," and for the fact that "there is a very close relationship between students and professors."

Nonetheless, at AAU they face all the challenges of studying in the developing world. "The power situation," Tofik mentioned almost as an afterthought, referencing the regular interruptions to electrical service that the entire city is subject to, the University included. The students cited the need for updated facilities as well. They have some new equipment, but also rely on equipment from the grant received when Prof. Teketel was still a doctoral student in the 1990s. The small and disconnected community of materials scientists in the region poses additional difficulties. Graduate student Fedlu Kedir said, "We hope to link with more people

Below: The gate to Addis Ababa University, the oldest university in Ethiopia. Right: The Addis Ababa Institute of Technology of Addis Ababa University. The Ethiopian Government has made applied sciences an educational priority, giving the school a central role in the country's development.



who are skilled.” The exchange of ideas is, after all, very much the blood in the veins of scientific research.

Prof. Teketel has ably juggled all of these challenges. An internationally respected researcher, he sits on committees and review boards, and maintains research collaborations with colleagues around the globe. In the absence of a true “sandwich program,” Prof. Teketel has leveraged his unique position to develop partnerships with programs in Europe and elsewhere. As a result, his students can take a 12- to 18-month research fellowship abroad in the middle of their degree.

During this time, they can study without the inhibiting factors of Ethiopia’s ongoing development and can begin forming their own relationships with the international community. It also brings with it all the rich experiences of cultural exchange. Hagos studied in Brazil, for example, but couldn’t speak Portuguese. “Some people ask me directions in Portuguese. What I do is just change my direction and go the other way,” he explained to a chorus of knowing laughter from his fellow students.

Moreover, with this time “sandwiched” between stints at home, the graduates are more likely to put their skills to use within the country. Prof. Teketel said, “These years are the times when students begin settling, making families.” Once established, graduates are much more likely to live and work in Ethiopia.

This is only possible, though, because Prof. Teketel ensures that they have the opportunity to be a part of the international materials science community from Ethiopia. He has been instrumental in the establishment of the African Network of Solar Energy, the Joint US-Africa Materials Institute, and the African Materials Research Society (Africa-MRS). This academic year, his students will also participate in a collaborative project with Prof. Teketel’s PhD co-advisor, Prof. Olle Inganas from Linköping University, to conduct small module testing for a private company.

On top of it all, Prof. Teketel helped host the 7th International Conference of the Africa Materials Research Society in Addis Ababa in December 2013. The plenary speaker at the Conference was Nobel laureate Prof. Robert Grubbs of the California Institute of Technology.

Over 300 scientists and engineers participated in the Conference, held at the impressive new African Union Conference Center. Events like these, well attended by the Ethiopian physical science and engineering community, ensure that AAU materials scientists as well as other students from across Africa get connected, and stay connected, with the international community.

“The future is uncertain,” said graduate student Girma Erjabo. As it is with Ethiopia, so it is with the materials science program. They need to acquire new equipment and increase the faculty, and Prof. Teketel added that he hopes the country’s industry will expand and create more jobs for graduates. Still, there is no better predictor of the future than the past, and recent history has shined on this promising new materials science program.

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