

Penn State AMRS Half-day Building Materials at the Human Scale Workshop

Date: 09/12/19

Venue: Nelson Mandela African Institution of Science and Technology (NMAIST)

Facilitators:

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Purpose of the workshop:

To equip participants with the theoretical and experimental aspects of drawing down carbon sequestration to efforts directed at promoting resource efficiency in the use of building materials. The expectation is that upon returning to their home institutions, the participants will develop research projects and educational materials focusing on the nexus of agriculture/agricultural waste, life sciences and building envelope materials.

Outline

Introduction to material-related low carbon/ circular economy challenge (Esther Obonyo, Penn State)

Buildings are central to meeting the challenges of the United Nations' 2030 Agenda for Sustainable Development and the 2016 Paris Climate Agreement. Scaled uptake of low carbon building materials can help attain the targets of this agreement. Historical and current patterns of natural resource use in all sectors including buildings have resulted in climate change and biodiversity loss. This module will discuss opportunities for addressing this problem through global partnerships for mega-science such as the Penn State-led Global Building Network, a partnership with the UNECE.

Cold sintering for building materials - progress, challenges, and future opportunities (Clive Randall Penn State)

This module will introduce speakers to cold sintering, an unusually low-temperature process that uses a transient transport phase, which is most often liquid, and an applied uniaxial force to assist in densification of a powder compact. By using this approach, many ceramic powders can be transformed to high-density monoliths at temperatures far below the melting point. Such low temperatures create a new opportunity spectrum to design grain boundaries and create new types of nanocomposites among material combinations that previously had incompatible processing windows

Government R & D on appropriate and low-cost building materials and technologies (Dismas W. Minja, Director General, Ag, NHBRA, Tanzania)

The National Housing Building and Research Agency (NHBRA) case study will be critiqued as an example of public sector-led efforts directed at promoting the uptake of low carbon materials in the African context through undertaking research, develop building materials and technologies and provide advisory services on different ways to improve housing. There is an emphasis on affordability, durability, standard hygiene, comfort and convenience and capacity building.

Mycelium-based composites for building structures (Jonathan Dessi-Olive, K-State)

This module will feature a series of mycelium construction experiments focused on staging monolithic “castings” of the increasingly popular bio-material. While several examples of large-scale architectural structure made from mycelium exist, all have used the material in through small-scale custom or modular units. The featured Tactical Mycelium experiments borrowed construction techniques from fabric-formwork concrete casting to develop tactics for monolithic mycelium construction.

Clay poured concrete (Gnanli Landrou ETH Zurich)

This module will feature a solution (Oxara) that has transitioned from research to commercialization It consists of using the landfill waste (excavation materials) that is locally available to produce a poured earth concrete. The innovators wanted the process to be simple and competitive to concrete. To this end, they the developed a cement-free concrete technology that allows one to cast the excavation materials in fresh state using concrete infrastructure and accelerate the hardening over time in order to remove the formwork after 24 hours

Discussion on low carbon building materials for Africa (Samuel Chigome, AMRS)

Participants will propose ideas on the next generation of low carbon building materials that used to address Africa’s adequate housing challenge. There will be a discussion on seeding activities within the individual campuses with the goal of establishing a Global-North-South-South collaboration within the AMRS network and the Penn State-led Global Building Network.

Table 1 Time table for the half-day workshop

Time	Activity
0830-0845	Introductions and purpose of the workshop
0845-0930	<i>Introduction to material-related low carbon/ circular economy challenge</i>
0930-1015	<i>Cold sintering for building materials</i>
1015-1030	<i>Break</i>
1030-11.45	<i>Mycelium-based composites for building structures Government R & D on appropriate and low-cost building materials and technologies</i>
1145-1230	<i>Clay poured concrete</i>
1230-1330	Lunch and NHBRA Case Study:
1330-1400	Discussion on low carbon building material solutions for Africa

