

Y. SAKAI LAB.

Next-Generation Construction Materials



Department of Human and Social Systems

Sustainable Construction Materials

Department of Civil Engineering, Graduate School of Engineering

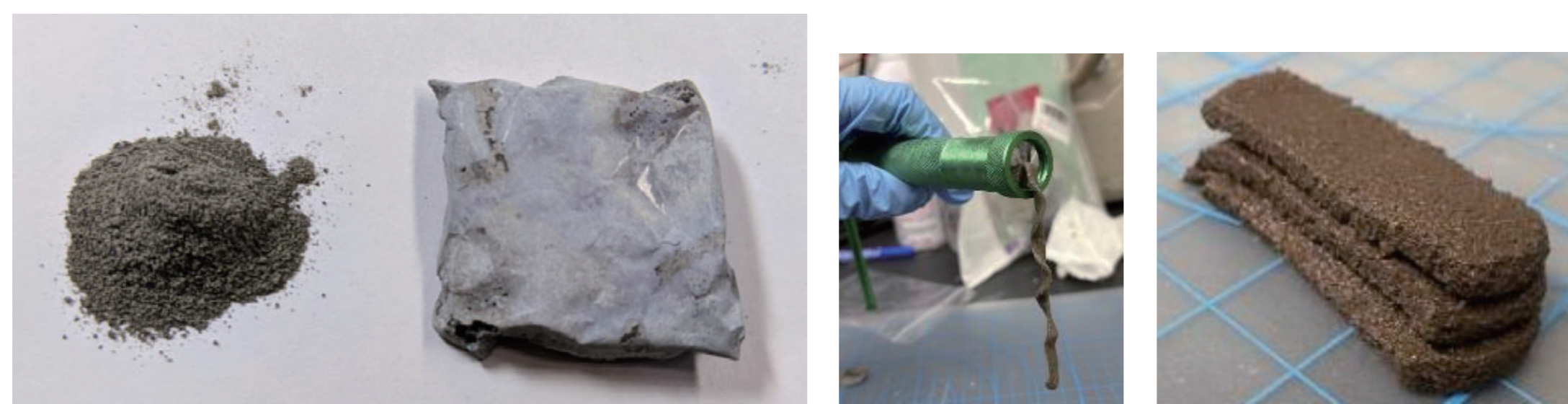
<https://ysakai.iis.u-tokyo.ac.jp/en>

Technology Development Towards a Sustainable Society

Concrete is a composite material made of sand and gravel bound by cement and water. Eight percent of the global CO₂ is produced by cement industries. Further, there is a shortage of sand and gravel. Our goal is to contribute to the development of a sustainable society by studying construction materials (concrete) to develop a sophisticated recycling system and construct durable structures.

Direct Bonding of Sand and Gravel

We are developing a method for producing hardened bodies from sand and gravel without using cement. The technology is also being advanced with the aim of application in space development, including lunar bases.

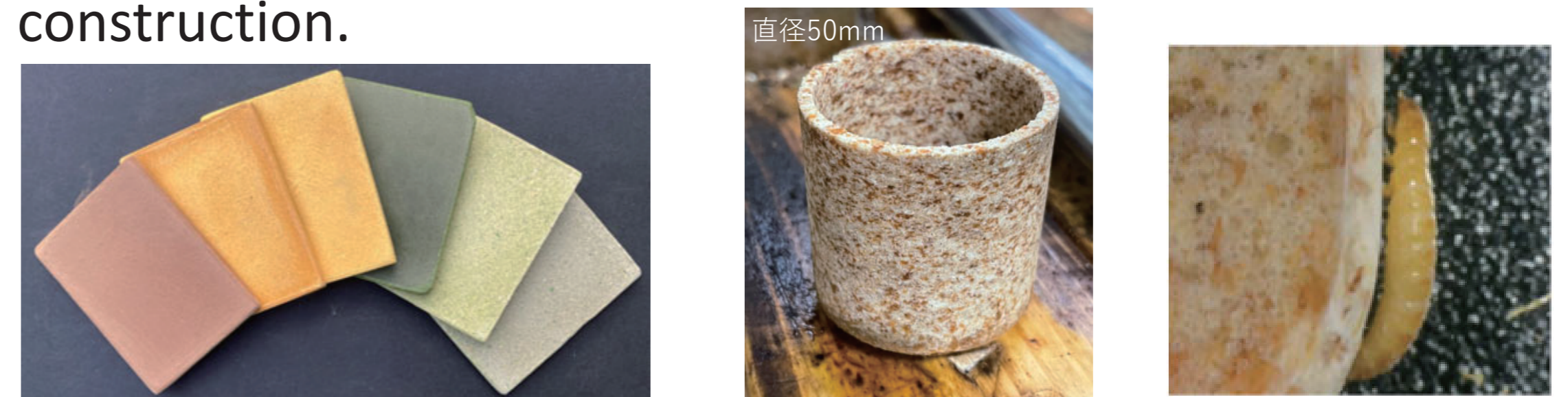


Simulated moon regolith

Application to 3D printing

Novel Materials From Food Waste

Considerable quantities of fruits and vegetables (edible and inedible parts) are disposed of worldwide. Leftovers are another huge food-loss and their disposal equally result in the emission of tons of CO₂. We aim to develop new materials from these waste products that can be used for construction.



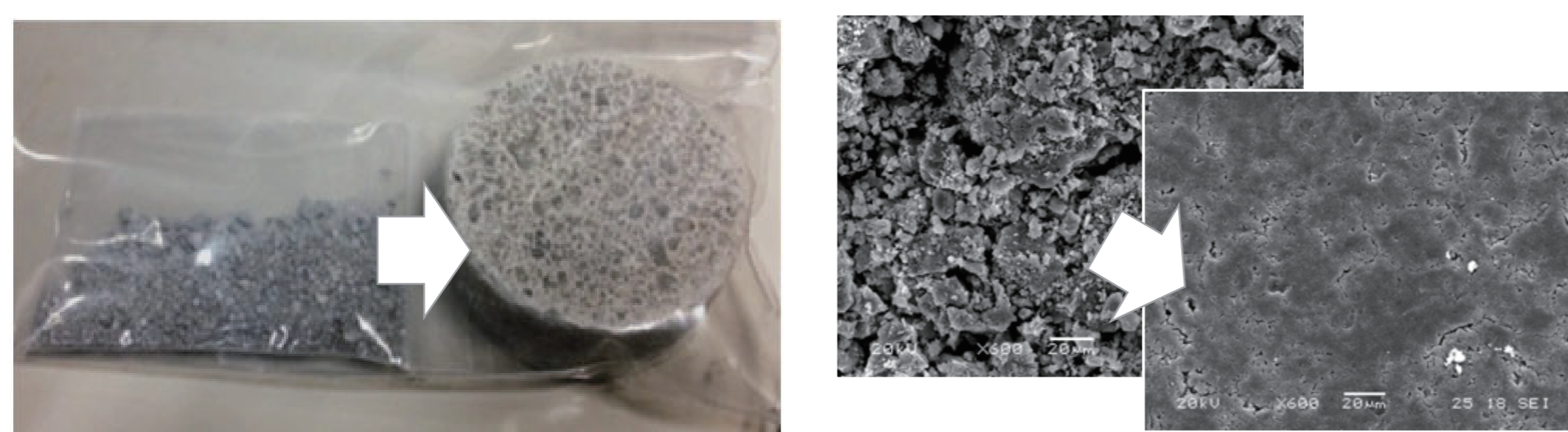
Plates produced from various fruits and vegetables

Cup (Bento waste)

Improvement of insect resistance

Complete Recycling of Concrete Waste

A novel recycling technique by compacting concrete waste has been developed to produce zero by-products and does not require new materials. By applying carbonation treatment, it can be a carbon-negative material.



Recycling of crushed concrete

Flow and densification by stress

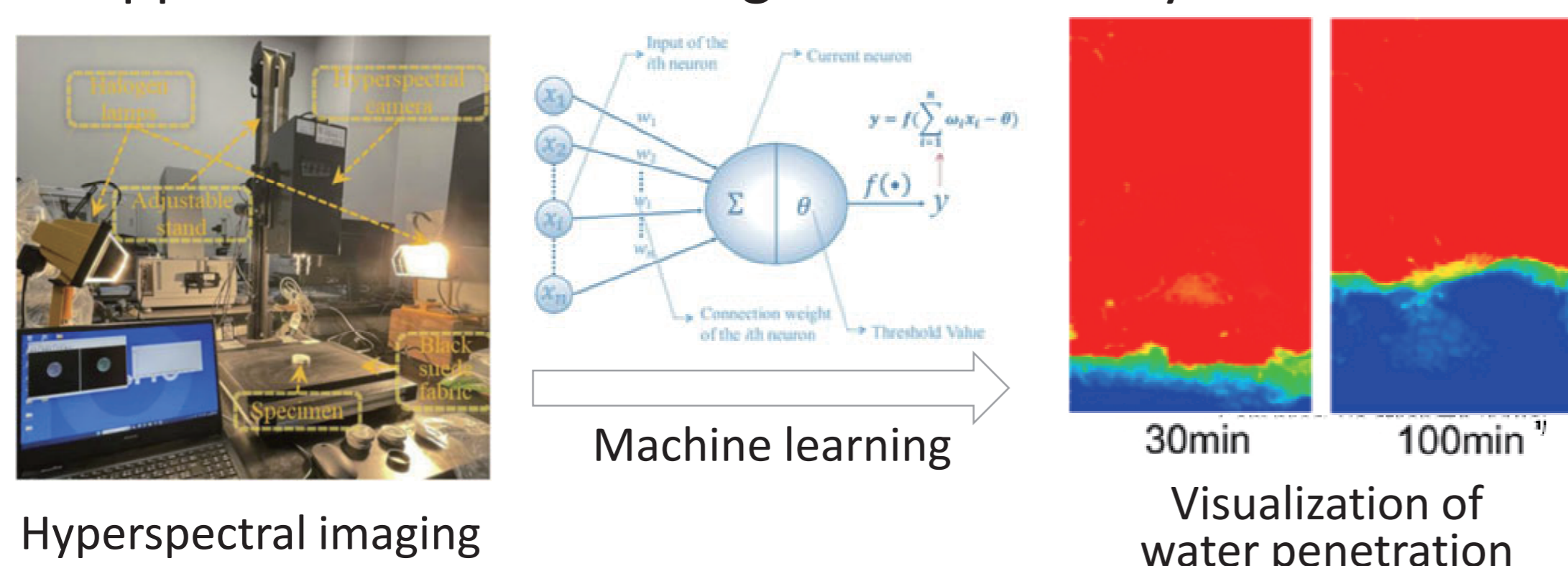
Botanical Concrete

This is a new technique that involves combining sand and gravel with wood or plants. The biodegradability, aroma, and color of the wood and plant can be enhanced in such concrete. Concrete and wood waste can be recycled using this technique.



Visualization of Water Content in Concrete

By visualizing water ingress into concrete using a range of novel techniques, we are deepening the understanding of penetration mechanisms and proposing models that can be applied in structural design and durability assessment.



Hyperspectral imaging

Machine learning

30min 100min¹⁾

Visualization of water penetration

Recycling of Plastic Waste

Plastic waste has a low recycling rate owing to unclean waste and the difficulty associated with separating the plastic types. Here, we produce recycled construction materials using low-quality plastic and construction wastes.



Plastic powder and inorganic waste