Y. SAKAI LAB.

Technology Development Toward Sustainable Society

Department of Human and Social Systems

Sustainable Construction Materials Engineering
Department of Civil Engineering, Graduate School of Engineering https://ysakai.iis.u-tokyo.ac.jp/en

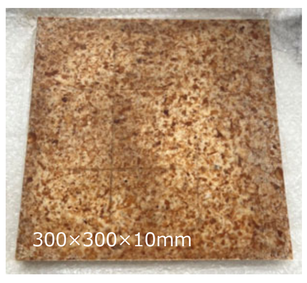
Technology Development Towards a Sustainable Society

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.

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



Panel (bread waste)

Cup (Bento waste)

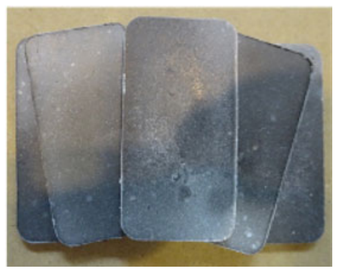
Botanical Concrete

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.

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



Direct Bonding of Sand and Gravel

A new technique that binds sand and gravel directly through a catalytic reaction without adding any cement paste has been developed. This technique is expected to be suitable for application in lunar bases.

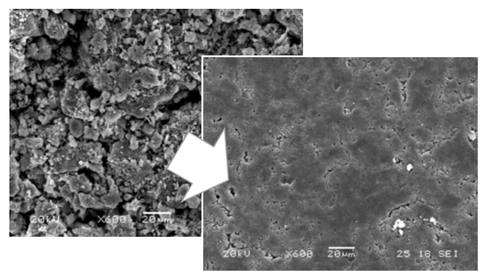
Namib desert sand

Simulated moon regolith

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. Here, the compressive strength can reach approximately 100 MPa.

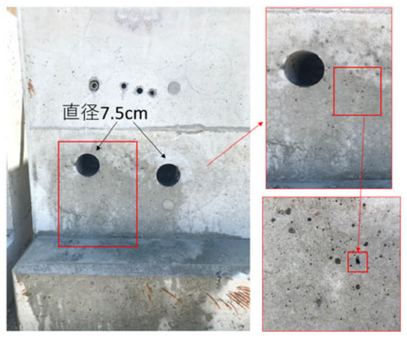
Recycling of crushed concrete

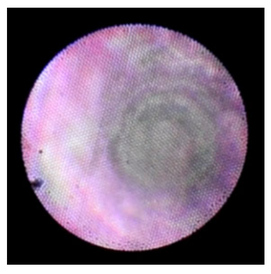


Flow and densification by stress

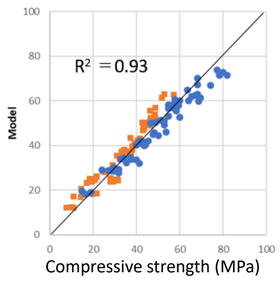
Inspection with Extremely Small Damage

Here, we developed techniques to evaluate the compressive strength, creep, carbonation depth, and frost damage of the concrete with very little damages (less than 1 mm hole diameter).





Observation with a fiber scope



Compressive strength estimation