

# SUSTAINABLE UTILIZATION OF WOOD-BASED MATERIALS IN HARMONY WITH ENVIRONMENT

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The sustainable utilization of wood and wood-based materials in both natural and urban environments requires the establishment of environmentally-harmonized innovative recycling system of resources in the humanosphere based on fundamental researches. Our major research topics are: ① Research and development of the integrated wood protection system, ② Feasibility of wood-degrading agents for environmental bioremediation and new-energy options, ③ Microtextural analysis of carbonized wood and development of non-platinum cathode catalysts for fuel cells, ④ Field survey of termite diversity in the tropical plantation forest. ⑤ Biological control for sustainable agricultural production. ⑥ Disease resistant behavior characteristic in social insects.

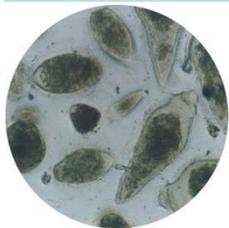
## Integrated wood protection system

Since it is expected to enhance the durability of wood and wood-based materials without any harm to the humanosphere and humans, a new-generation treatment concept should be evaluated. The use of supercritical carbon dioxide is promising with the aid of knowledge of deteriorating agents and mechanism. The combined facility, "Deteriorating Organisms Laboratory (DOL)"/"Living-Sphere Simulation Field (LSF)" is open for scientists to promote inter-university/international research collaborations.

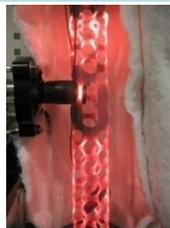
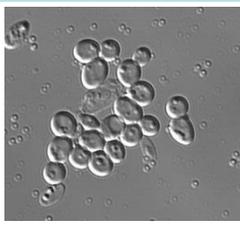


Biological deterioration of wood found in the survey of "Hanshin-Awaji Earthquake Disaster" (left), and the deterioration agent "Termites" (right)

## Feasibility of wood-degrading agents for environmental bioremediation, thermal conversion and extraction technology for new-energy options



Symbiotic protists and bacteria producing  $H_2$  and  $CH_4$  from termites

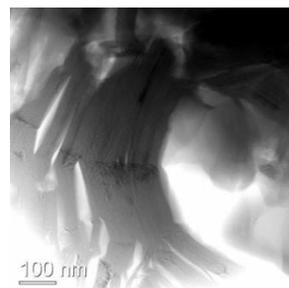


Furnace for Fast-pyrolysis

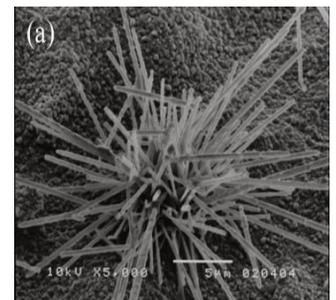
Biological detoxification and extraction of preservative-treated wood and wood-based materials with microorganisms and termite-symbionts, and development of new energy options such as bio-hydrogen, bio-methane bio-oil by wood-degrading organisms or fast pyrolysis are being intensively studied.

## Novel Wood-based carbon materials

Development of novel wood-based carbon materials such as PEFC by designing the micro- and nano-carbon-structure is the main research target. SiC/C composite and catalytic graphite material from carbonized wood by pulse current sintering are also developed as a high functional wood-based carbon.



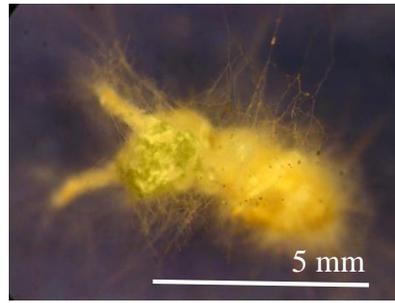
Elemental graphitic structures grown in sintered carbonized wood



Porous SiC nanorods grown on the surface of carbonized wood

## Sustainable IPM

Hygiene behaviors in insects play important role to prevent pathogenic infection. These behaviors are powerful but ambiguous especially in social insects. For establishing the sustainable pest management system through microbial control, it is essential to clarify the behavioral resistance against pathogens.



Infected termite and entomopathogenic fungi

## Key words

*Wood protection, Deteriorating Organisms Laboratory (DOL), Living-Sphere Simulation Field (LSF), Termite, Decay Fungi, Non-destructive detection, Supercritical fluid treatment, Bioremediation, Environmental conservation, Bio-energy gasses, Bio-hydrogen, Bio-methane, Carbonized wood materials, SiC/C composite, Microtextural analysis, Fuel cells, termite diversity in the tropics, Biological control, insect pathology*