Creation of Environmentally Friendly Materials using Agricultural Byproducts and Development of Nondestructive Testing Methods

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Abstract

The increasing number of aging in-service agricultural infrastructures has focused on the need to inspect damaged material. In Japan, many concrete structures have been used for more than 40 years, suggesting existing damage conditions. Furthermore, Japan is one of the regions with the highest risk of natural disasters, and most of the structural deterioration is caused by floods, earthquakes, and freeze-thaw processes. Therefore, damage evaluation approaches for diagnostic inspection are in high demand.

Acoustic Emission (AE) technology is one of the adopted approaches to investigating material deterioration. This paper suggests the evaluation method of concrete's damages is proposed by AE energy under a process of compressive fracture. To investigate damage levels in concrete core specimens, the correlation between the AE energy release trend and X-ray CT parameters was conducted. These results suggest that initial AE energy characteristics depended on the degree of damage[1]. AE energy is an effective parameter for evaluating the degree of damage that is not fully understood by compressive strength. Currently, through international collaboration, we are studying the selection of useful AE parameters and improvement of evaluation accuracy using machine learning[2].

To achieve sustainable conservation of rural areas, it is necessary to develop not only existing materials such as concrete, but also more environmentally friendly structural materials. This paper suggests developing eco-friendly materials that effectively utilize rice husks and rice straw, which are agricultural by-products. Rice husk ash reacts chemically with cement (pozzolanic reaction) to increase the chemical resistance and long-term strength of structural materials. The developed material helps to utilize agricultural by-products and has the advantage of generating electric and thermal energy in the rice husk combustion process. As a case study, the carbon dioxide emissions of a rice husk gasification plant were calculated, and it was found that the use of rice husks can reduce carbon dioxide emissions by 47 tons per year[3].

I would like to further deepen my research and strive to contribute to the development of academic research in Japan.

References

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