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OVERVIEW OF "SOLID COMBUSTION" EXPERIMENT IN THE ISS/KIBO

Abstract

A lot of astronauts have been staying in the International Space Station(ISS) for long term. They have carried out many scientific experiments in the microgravity environment. To secure their safety, the protection against fire is a particularly important issue. However, the current material flammability tests for fire safety in space are performed in the normal gravity, and it is known that the material flammability could be enlarged in microgravity in some conditions. Therefore it is necessary to understand the impact of gravity on the the material flammability. Our research entitled "Quantitative Description of Gravity Impact on Solid Material Flammability as a base of Fire Safety in Space(Solid Combustion)" will be carried out in the Japanese Experiment Module/KIBO in the ISS. The main target of the research is to clarify the impact of gravity on the the material flammability. The experiment will employ the Multi-purpose Small Payload Rack (MSPR). In the research, three types of solid material (polyethylene insulated wires, PMMA sheet, and filter paper) are selected as the test samples. With the samples, the flammability in microgravity regarding two fundamental processes of solid combustion , that is ,(1) solid material ignitionand (2) flame spread over solid material, is quantitatively investigated. In the experiment regarding to (1), the both ends of the polyethylene insulated wire are electrified and the presence or absence of the ignition is investigated under the several conditions of the oxygen concentration , current value, electrified time . In the case of (2) , the downwind end of the samples is ignited and the flame spread is observed under the several conditions of the pressure, oxygen concentration, flow speed. From these results, it is possible to obtain the ignition map of overloaded wire and the flammability map of spreading flame in microgravity . Then, the validity of the current flammability tests will be verified with clarifying the discrepancy between the data in normal and microgravity. The experiment device under development has the following functions. The first function is to regulate the oxygen concentration, temperature, pressure and air flow velocity. The second function is to ignite the samples. The third function is to observe the ignition and the flame spread. Finally, the fourth function is to feed the samples into the experiment area. In the present report, the overview of the Solid Combustion experiment will be described.