

Overview of Kibo experiment candidates for around 2012

1. Experiment Title

Quantitative Description of Gravity Impact on Solid Material Flammability as a base of Fire Safety in Space

2. Principal Investigator

Osamu Fujita

Division of Mechanical and Space Engineering

Hokkaido University

3. Outline of Experiment

NASA's material flammability tests for fire safety in space are attained in normal gravity, while it is known that the material flammability could be higher in microgravity in some conditions. Therefore, it is important to understand the impact of gravity presence on material flammability. In the present research, two types of solid material, polyethylene insulated wire and flat plastic sheet are selected as test samples and their flammability regarding two fundamental processes of solid combustion, that is, (1) solid material ignition, and (2) flame spread over solid material, will be quantitatively determined in microgravity. Then, the discussion on the discrepancy between the data in normal and micro gravity will be made to give the validity of NASA's material flammability tests. Further, the "material flammability map" in long-term microgravity environment for the selected samples will be given as a fire safety data base in space, which could be reference data to estimate flammability of other solid materials having similar geometrical configuration. Figure 1 shows a conceptual description of flammability map of overloaded electric wire in terms of O₂ concentration and electric current. It is already known that the ignition limit is extended in microgravity but it is difficult to determine the actual lowest limit by the ground-based microgravity facility because of very long ignition delay time near the limit. Figure 2 conceptually describes the condition where spreading flame is sustained. The extinction limit (LOI) will be extended in microgravity but it is difficult to determine the actual limit without long-term microgravity experiments.

