

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)  
Science Results from Ground Based Research (4)

Author: Mr. Min kuk Kim  
Seoul National University, Korea, Republic of, bebop76@snu.ac.kr

Prof. Suk Ho Chung  
Seoul National University, Korea, Republic of, shchung@snu.ac.kr  
Prof. Osamu Fujita  
Hokkaido University, Japan, ofujita@eng.hokudai.ac.jp

EFFECT OF AC ELECTRIC FIELDS ON FLAME SPREAD OVER ELECTRIC WIRE

**Abstract**

Electric-wire fire is one of the important issues for the safety and survivability of a spacecraft. In previous researches, various factors, such as the size of wire, the types of insulation, gravity levels, the conditions of ambient flow and dilution, have been investigated to resolve the issues of fire-safety pertinent in both ground and space environments. In case of actual fire for electric wires, however, there might be electromagnetic fields induced by the voltage and/or current passing through the wire. In the reaction zone of flame spread, there exist abundant charge carriers which could be influenced by the electric fields. Thus, the flame spread behavior could be affected by electric fields. In spite of this possibility of the influence of electric fields on flame spread of wire-flame, the effect of electric fields on the characteristics of flame spread over insulated wire has not been studied. The present study investigated the effect of electric fields on the characteristics of flame spread over insulated electric wire experimentally by varying AC voltage applied to the wire in the normal gravity condition. Ethylene-tetrafluoroethylene (ETFE)-insulated copper wire was tested which has the outer diameter and inner diameter of insulator of 0.8 and 0.5 mm, respectively. The wire was placed horizontally on electrically insulated posts and one end of the wire was connected to the high voltage terminal. Thus, the electrical system is the single electrode configuration. The insulator was ignited at one end and the flame spread rates along the wire have been measured by using a high speed camera at various conditions of applied AC voltage and frequency. The result showed that the spread rate decreased with the applied AC voltage and over a certain critical voltage the flame was extinguished. For a fixed applied voltage, two distinct regimes existed depending on the applied AC frequency. In the regime of low AC frequency, the flame spread rate decreased with the applied AC frequency. In the high frequency regime, the flame spread rate increased with the applied AC frequency even over the spread rate without applying electric fields. This result implies that the fire safety code developed based on without applying electric fields needs to be modified in case of the fire for electric wires experiencing electric fields and suggest a need in conducting experiments in a microgravity condition to be applied to the fire-safety for a spacecraft.