**Vol. 12, No. 4, 2003**

# SHS Technology for In-Situ Resource Utiluzation in Space

**E. Miyazaki and O. Odawara**

***Office of Research and Development, National Space Development Agency of Japan***
***Sengen 2-1-1, Tsukuba, Ibaraki 305-8505 Japan***

***Department of Innovative and Engineered Materials, Tokyo Institute of Technology***
***Nagatsuta 4259, Midori-ku, Yokohama 226-8502 Japan***

Self-propagating high-temperature synthesis (SHS), has been proposed as one of the key technologies for In-Situ Resource Utilization (ISRU),. The influences of gravity and pressure on the process using iron oxide and aluminum powders, i.e., thermite reaction, were investigated using reaction propagation rate measurements and qualitative analyses in this work in order to assess the applicability of SHS to ISRU in space. The gravity environments are normal (1G) and microgravitational (μG) and were prepared at a drop tower facility, and pressure environments were “low” at ~200Pa and normal with argon gas at $1x10^{-1}$MPa. For the reactants, iron oxide of ~50 μm was used and three kinds of aluminum powders were prepared varying their powder size between ~40 μm and ~160 μm. As a result, we confirmed that SHS is applicable to ISRU under appropriate condition. That is, ignition, reaction propagation, and structuring can occur under such conditions as microgravity and low pressure. When the rate for 50 μm aluminum was compared, the reaction propagation rate under μG was smaller than that under 1G. On the other hand, when 40 μm aluminum was used under μG, the rates were largely scattered in both pressure conditions. Qualitative analysis showed the completion of the reaction, except for the case of 160 μm in low pressure under normal gravity. Hercynite was found, and it is normally produced more under low pressure than under normal pressure. The results also showed that the yield of the product should be better for practical use in future.