

J-1

宇宙環境利用とイノベーション

Space Utilization and Innovation

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Abstract

Space utilization for materials science and engineering was initiated by a concept of “The Industrialization of Space” in 1977, when US made a success of the Apollo Project followed by a plan for launching a Space Shuttle ¹⁾. Space utilization plan in Japan was determined by the Government Space Activities Commission in 1985. The report by Gatos et al. gave a big impact to not only scientists but also to business people and high-ranked government officials, because a defect-free (striation-free) compound semiconductor InSb single crystal was grown in the Apollo-Soyuz project ²⁾. This was attributed to suppression of gravitational oscillatory convection in microgravity condition and resulted in a space fever all over the world, saying that defect-free GaAs single crystals can be produced aboard space factory.

In Japan space activity was exclusively managed by Science and Technology Agency (STA) at that time. However, in 1986 the Ministry of International Trade and Industry (MITI) established Space Technology Corporation, so that industries can join space materials science and engineering experiments.

Although the concept of “The Industrialization of Space” looked a propaganda from the materials scientist point of view, a concept of physics of gravity-dependent phenomenon was fascinating and established through space utilization program promoted by JAXA. Gravitational acceleration contributes to Gibbs energy to the small extent, whereas transportation phenomena are affected to the great extent.

Gravitational acceleration less than 1G cannot be obtained stationarily on earth. World of variable gravitational acceleration: i.e., 10^{-4} to 1 G, is a frontier for new physics and life science. Variable gravitational acceleration does not mean a KAIZEN environment but an innovative one for science. In microgravity condition scientists have a chance to find new phenomena beyond their hypothesis and prediction imagined on earth, i.e. serendipity and a quantum leap, which cannot be allowed for development of a new product on earth but is OK for science.

1) R. L. Hammel and D. M. Walts, “The Industrialization of Space”, ed. by R. A. van Patten et al., Advances in the Astronautical Sciences vol.36, Proc. 23rd Annual AAS Meeting, Oct.18-20, 1977, San Francisco, CA., (1978) 363.

2) A. F. Gatos et al., Journal of Electrochemical Society, vol.122 (1975) 276.

