

우주용 탄소/에폭시 복합재료의 열물성 거동에 관한 연구**(A Study on Thermophysical Behavior of
Carbon/Epoxy Composite for Spacecraft Application)**이 호 성

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Recently polymer matrix composite materials have been among the most widely used materials for aerospace and space applications due to their higher specific strength and stiffness with effective design flexibility. Materials properties required by spacecraft structure differ from those by aircraft applications. The major difference includes high stiffness, low coefficient of thermal expansion, and dimensional stability in space environment. High performance composite materials have been considered to satisfy these requirements and simultaneously reduce the structural weight of expensive spacecrafts. However, the high performance composites are different from metallic materials in terms of failure mode, elastic behavior, strength, and reliability in addition to the sensitivity to space environment like microgravity, intense radiation, cyclic radiational heating and cooling, and vacuum. The objective of this presentation is to investigate the thermophysical behavior of high performance carbon/epoxy composite materials for spacecraft application.

The composite specimens were composed of YS90A carbon fiber with 6,000 fibers per tow and DGEBA(Diglycidyl Ether of Bisphenol A) resin for high temperature application. The YS90A fiber is a continuous high modulus(880 GPa), pitch based fiber. For the purpose of comparison, T300/epoxy composite specimen was also prepared in a form of tape and fabric with the same process. These materials were characterized by measuring resin content, volatile content, gel time, DMA, TMA, and DSC. Thermal expansion and conductivity properties were measured. Mechanical properties were also measured at three different temperatures. In order to study the effect of thermal cycling to the properties due to difference of coefficients of thermal expansion, the thermal cycling test was performed. After thermal cycling, flatwise tensile test and flexure test of sandwich were performed. This study has showed that high performance polymer composites offer potential in the use of spacecraft application.