

Honeycomb composite structures of aluminum: aerospace applications

ABSTRACT

A honeycomb composite structure is usually composed of a lightweight hexagonal core sandwiched between two thin face sheets that are adhesively joined. Both the core and the face sheets can be combinations of many types of materials depending on the application. In this article, an overview of the design and manufacturing process of aluminum honeycomb composite structures particularly for aerospace application is presented. Aluminum honeycomb composite structures are lightweight constructions with high specific strength and stiffness that are applied mainly in the aerospace industry. An aluminum honeycomb panel is typically made up of the secondary structural components and interiors of an aircraft such as the wing skin, trailing edge, control surface, flooring, partitions, aircraft galleys, and overhead bins, to name a few. Other applications are in the spacecraft, helicopter, missile, and satellite. Owing to its honeycomb design peculiar to the hexagonal beehives, it can reach more than 30 times higher in stiffness and 10 times higher in flexural strength compared to its solid counterpart of the same weight. The mechanical properties of the honeycomb composite structure hinge on the materials of the core and face sheets, the core geometries, and the thickness of the face sheets. Designed for superior flexural and shear loading, the selection of the optimal honeycomb design will depend on the application requirements. The principal design criterion of a sandwich structure in aerospace applications is weight saving, and there is a trade-off between performance and cost. In terms of manufacturing of the honeycomb composite sandwich structure, the two main processes are the expansion process commonly used for low-density cores and the corrugation process for higher density cores.