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Nomex Honeycomb Core Forming for Curved Composite

By Tata Advanced Materials | Category: Implemented Innovations

Centre for Airborne Systems (CABS), Bengaluru - a part of DRDO identified Tata Advanced Materials Limited for manufacture of composite radome. Flexible nomex honeycomb core "sandwiched" between glass face sheets was the design recommended by customer. The flex core selected by the designers due to the parts shape and core's ability to drape the profile but flex core was expensive. So bending/forming of rigid hexagonal (hex) honeycomb core, which was very rigid at the thickness specified was explored. TAML developed the technology for core forming in-house and implemented the same to manufacture the single biggest composite flying part

The Context

The product to be developed was a doubly curved sandwich structure. It was necessary to ensure that the core is formed to the part profile for effective bonding between the skin layers and the core. Any deviation in the core profile would result in:

- De-bond between skin and core
- Dimensional variation subsequently affecting the assembly

Overcoming Challenges

The key challenge faced was the core's spring-back after forming

Impact of the Innovation

saving per set of radome

₹16 mn

The Innovation

The need for a process to bend / form the core arose from the doubly curved sandwich radome that was to be developed for CABS. The standard solutions available in the market for realizing a curved structure were:

- Machine the core from a block to the required profile
- Buy the bent core from the supplier (process is patented)
- Use flex core (not sure of flexibility level for higher thickness)

None of these options were suitable for the current requirement. Developing a process in-house for forming the hex core was the need of the hour. Several aspects had to be evaluated before commencing the work:

- Hot forming vs cold forming
- Positioning the core
- Load application
- Profile retention after load removal

Many trials were conducted for the same. Literature survey revealed that hot forming was the preferred choice world over. Different methods were used to position and bend the core in terms of mechanical load (such as ropes, clamps etc.) and vacuum load. In the case of doubly curved structures, applying mechanical load was not sufficient to bend and form the core to the required shape. The load application had to be uniform across the profile. Applying uniform load using vacuum was identified as the best process for forming the cores to the required shape.

The vacuum bagging technique which was being used regularly in-house for part fabrication was modified suitably to permit forming of cores. The propriety of the technology developed lies in the material and method used for bagging the core and the temperature and pressure levels required to form the same.