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ACOUSTIC PERFORMANCE OF FOAM FILLED HONEYCOMB SANDWICH STRUCTURES

Abstract

Payload fairings of a launch vehicle is designed to withstand the acoustic loads that is experienced by launch vehicle during the atmospheric flight regime. The acoustic protection system that consists of acoustic blankets made up of glass wool and microlite foam that are commonly used in launch vehicle, however, consumes more dynamic space. Many attempts were made since the year 2000 to bring down the attenuation level by filling the cells with foam as in the case of honeycomb sandwich fairings. It is observed from the analytical studies reported in literature that for low frequency range up to 300Hz, the sound insulation index is governed by damping control and beyond this range till 800Hz by mass control. In the damping control region, semi flexible poly urethane foam (PUF) foam generated better acoustic performance than rigid and flexible foam. However, embedding semi flexible PUF slab inside honeycomb cell has many limitations such as bring out uniform density with low density, free from core contamination for good skin to core bonding etc, In the present study, polyimide foam is embedded inside the honeycomb cell and metallic skinned sandwich panel of configuration of 0.5/23/0.5mm is fabricated to the required size of 1500 x 1200 x24mm. The transmission loss (TL) for a range of frequency between 50Hz to 8000Hz is evaluated using reverberation chamber as per ASTM E 90. Comparison of transmission loss of foam filled honeycomb panel shows a higher transmission loss by a minimum value of three dB w.r.t bare panel (without foam inside the honeycomb cell) for the critical range of frequency of 100Hz to 500Hz. Below 100Hz as expected, at the natural frequency of the panel lowest TL of 1.7dB was obtained when compared to bare panel for a source of 108dB of the reverberation chamber. When polyimide is replaced with poly urethane foam, no significant change in TL is observed. It has been concluded based on present study that airflow resistivity of polyimide that is above 200,000Pa s/m is responsible for the characteristics on TL of the foam filled sandwich panel when compared to either bare or PUF filled panel.