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PERFORMANCE EVALUATION OF SRM FLEX SEAL REALIZED THROUGH ALTERNATE MOULDING PROCESS

Abstract

PSLV's third stage Solid rocket motor employs flex nozzle for thrust vector control. The vectoring of the nozzle is enabled through flex seal which allows the nozzle to vector in Omni-axis direction. Flex seal consists of alternate layers of elastomeric pads and metallic shims which are bonded to form an axis symmetric composite structure.

The existing flex seal is realized through compression moulding technique, where the elastomeric pads are first extruded separately to the required shape and then stacked between metallic shims, located in the mould. The thickness of the pads on moulding is controlled by keeping metallic spacers between the metallic shims. After stacking of elastomeric pads, shims and closure of the mould, the flex seal is subjected to a combined loading of pressure and temperature under a specified cure cycle.

To overcome the limitation of present compression moulding scheme like relative motion of shims during loading and to enhance the batch production, transfer moulding scheme was successfully adopted for the realization of flex seal. In transfer moulding, the rubber compound is directly placed between the mould assemblies and forced to flow in to the cavity between shims under high pressure and temperature. Metallic spacers are placed between the shims at outer diameter to control the elastomer thickness. The required load is subsequently applied on the mould under specified temperature and time. The merits of transfer moulding route are (a) no need for the extrusion of rubber pads and stacking the pad between shims, which saves time and manpower hence enhanced production rate (b) better control of dimensions, since no relative motion between the shims based on mould construction/assembly (c) Transfer moulding route is widely followed for complicated components which requires close control of dimensions.

Trial mouldings were carried out to finalize the process parameters. The thickness, mass and NDT of the trial moulded pads were found satisfactory. Flex seals realized through transfer moulding route

successfully under gone all acceptance tests like proof pressure test, null position test and vectoring test. All the test parameters like seal axial compression, shims strains, actuation load, stroke etc were consistent and comparable with existing compression moulded flex seals. Subsequent to the acceptance testing, the performance of the transfer moulded flex seal was successfully evaluated in full scale hot test of PSLV's third stage SRM and the integrated performance of the flex nozzle control system was satisfactory.