

عنوان مقاله:

A study on the application of ablative composites in nozzles for rocket engines

محل انتشار:

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خلاصه مقاله:

Ablation is a heat and mass transfer process in which a large amount of heat is dissipated in a very short period of time with sacrificial loss of material. Ablative composites are polymeric composites where the reinforcement is generally a fibre with high melting point like Carbon or Silica and the matrix is a high char yielding resin like phenolics. Ablative composites are an elite class of composites made of high melting point fibers and polymeric resins with very high char yield. Commonly used reinforcements include carbon, graphite, silica, glass, asbestos etc and resins include phenolics and furfuryl alcohol. Solid rocket motor nozzles and liquid engine throats use ablative composite materials to protect the structures from the extremely severe operating conditions of high temperature, pressure and particle impingement. These ablative nozzle liners are processed from carbon phenolic/silica phenolic prepregs using a complex processing cycle. The process starts from impregnating the fibres with phenolic resin followed by either moulding or wrapping/winding prepreg tapes over metallic mandrels followed by polymerization under pressure. Traditionally, prepreg is cut into straight tapes and wound on mandrels to form the divergents. For throats and convergents, prepreg patterns are cut and stacked for curing. Plies of shape conforming to the development of base cone are cut from the prepreg and wound on the mandrel. After polymerization, the final required configuration is machined from this cylindrical blank after the liners are cured. The new method, described in this paper, replaces the straight-cut prepreg tapes by bias-cut prepreg tapes. These can be used for ablative liners in which the plies are at an angle to the direction of the flow. Bias tapes are cut at 45° to the warp and weft directions of the fabric to the required width and formed to the required frustum of cone. Since the cone is formed from straight cut bias tape, the fibre construction will be uniform around the circumference unlike the pattern cut tape. The efficiency of this process depends on the wrapping ratio which is in turn a function of the diameter, ply angle and tape width. To get the best wrapping ratio, shaped mandrels are used which brings down the material wastage and machining allowances. This paper describes the attempts to develop the Bias wrapping technology for angle wound liners. The details of process trials, challenges faced and how they were overcome, advantages of the process over conventional process etc are ... explained. Exhaustive material characterization of th

کلمات کلیدی:

.ablative composites, carbon phenolic, silica phenolic, tape winding

لینک ثابت مقاله در پایگاه سیویلیکا:

