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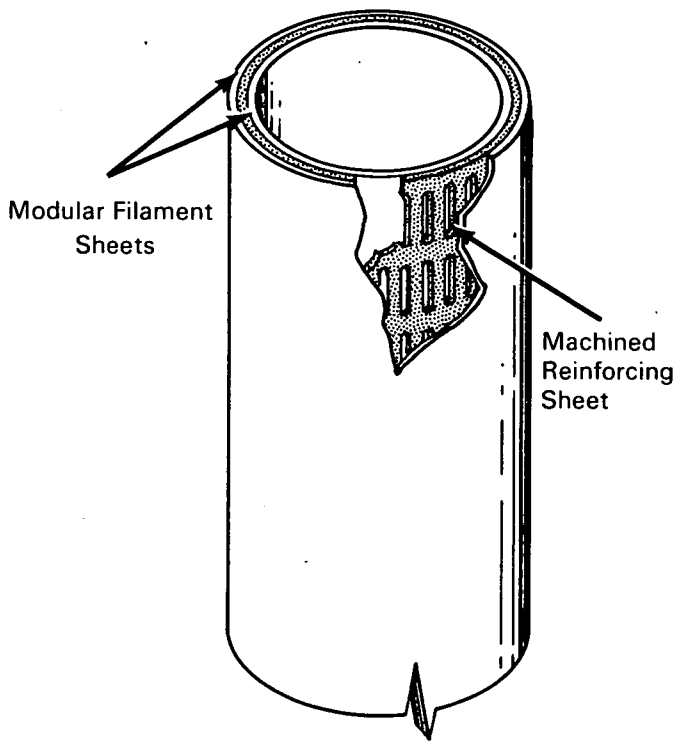
NASA TECH BRIEF

Laminated Sheet Composites Reinforced with Modular Filament Sheet



Laminated sheet or plate composites, reinforced with modular filament sheet or plate, can be produced by diffusion bonding and explosive bonding procedures and used in applications requiring filament reinforced metal matrices. Aluminum and magnesium composite sheet laminates reinforced with low density, high strength modular filament sheets have been successfully produced by both diffusion bonding and explosive bonding. Both processes are accomplished in normal atmosphere and require no special tooling or cleaning other than wire brushing the metal surfaces just prior to laminating. The method of fabrication is simple and inexpensive, as the preformed modular filament sheets need only to be wire brushed and alternately stacked with matrix metal sheets and bonded by either of the two processes, which have been proven and are well established.

Present techniques for joining filament reinforced metal sheet require special tooling and jigging for proper positioning, prestressing, and spacing of filaments during the joining process. Also, present wire reinforced sheets are joined by diffusion bonding in a vacuum or inert atmosphere by either forge pressing, rolling, or brazing. The combined tooling and acces-

(continued overleaf)

sory equipment for atmospheric control makes the diffusion bonding in a canned retort a relatively costly method.

This method incorporates the use of low density high strength preformed sheets for reinforcing and strengthening low density high strength ductile matrices. The longitudinal and lateral properties can be controlled by varying the frequency and width of the ribs in each direction. A sheet uniformly punched with round holes and explosively bonded between sheets of an appropriate matrix metal should produce a composite sheet having approximately equal tensile properties in the longitudinal and transverse directions. Optimum hole size, pattern, and frequency would depend upon the specific application under consideration. The concept shown in the figure would be adaptable for cylindrical tankage and fuel ducting where compressive axial loads and hoop stresses are encountered.

Another advantage of the filament sheet laminate is that, in flat plane applications, the window frame border can be readily adapted to conventional methods of joining with rivets, bolts, fasteners, etc. Also, reinforcing eyelets and integral washers can be designed into the sheets at close-out areas and where complete penetration by fasteners is required.

Notes:

1. Laminated sheet or plate utilizing modular filament sheets can be inexpensively produced by diffusion bonding, forge pressing, roll bonding, and explosive bonding. The production cost is much lower than comparable laminates reinforced with wire. Maximum cost reduction and fabrication ease are realized through explosive bonding.
2. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B68-10146

Patent status:

No patent action is contemplated by NASA.

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