in N-methyl-2-pyrrolidinone (NMP), then most of the NMP is removed by evaporation in hot air. In the present case, the polyamid acid is, more specifically, that of LaRC™ IAX (or equivalent) thermoplastic polyimide, and the fibers are, more specifically, Manganite IM7 (or equivalent) polyacrylonitrile-based carbon filaments that have a diameter of 5.2 µm and are supplied in 12,000-filament tows.

The present process stands in contrast to a prior process in which HYCARB tape was made by pressing boron fibers into the face of a wet carbon-fiber/poly(amide acid) prepreg tape — that is, a prepreg tape from which the NMP solvent had not been removed. In the present process, one or more layer(s) of side-by-side boron fibers are pressed between dry prepreg tapes that have been prepared by the aforementioned “wet to dry” process. The multilayer tape is then heated to imidize the matrix material and remove most of the remaining solvent, and is pressed to consolidate the multiple layers into a dense tape.

For tests, specimens of HYCARB tapes and laminated composite panels made from HYCARB tape were prepared as follows: HYCARB tape were fabricated as described above. Each panel was made by laying down ten layers of tape, containing, variously, one, two, or three boron-fiber plies and the remainder carbon-fiber-only plies (see figure). Each panel was made by laying down ten layers of tape. Each panel was then cured by heating to a temperature of 225 °C for 15 minutes, then pressing at 200 psi (≈1.4 MPa) while heating to 371 °C, holding at 371 °C for 1 hour, then continuing to hold pressure during cooling. Control specimens that were otherwise identical except that they did not contain boron fibers also were prepared. In room-temperature flexural tests, the HYCARB specimens performed comparably to the control specimens; in room-temperature, open-hole compression tests, the HYCARB specimens performed slightly better, by amounts that increased with boron content.

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to NASA Glenn Research Center, at (757) 864-3521. Refer to TSP (see page 1).

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Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Commercial Technology Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-17605-1.