

New Materials from Aerospace



Three emerging technologies in the aerospace industry offer potential to boatbuilders for lightning protection, adjustable running surfaces, and stronger laminates.

COURTESY: FLEXSYS

BY BRUCE PFUND

Editor's Note: Modern boatbuilding is dominated by the composite materials and techniques that have come to define the industry and the boats we build. But most of our current structures and build practices were originally developed for other industries and applications. In a trade as modest as boatbuilding, we tend to get what trickles down from the research and development of others, so it's important to keep an eye out for

some of the many advances in the aerospace and automotive sectors that could change how we design, build, and even use boats in the near future. Former Professional BoatBuilder technical editor, and composites consultant Bruce Pfund shows how new ideas from outside our trade could significantly improve the way we build boats.

—Aaron Porter

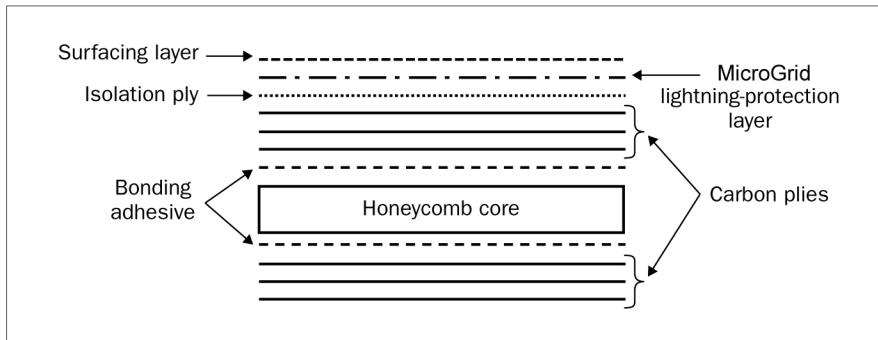
Lightning Damage Alert

Because carbon fiber is electrically conductive and increasingly common in modern aircraft construction, lightning strikes carbon composite components hundreds, if not thousands, of times per day. On the water, where carbon composite sailboat masts have become more popular, the consequences of lightning strikes are expensive to repair and difficult to diagnose, particularly when the strike leaves no visible damage at the spar tube's surface. A variety of non-destructive testing (NDT) inspection techniques have

been applied with varying degrees of success (see "Carbon and Lightning," *Professional BoatBuilder* No. 128). Thermography and laser shearography can reveal delamination, as can ultrasonic testing, but testing every square inch of a spar tube is time-consuming; and if baseline NDT is not performed before the spar entered service, all these methods will be compromised. (Baseline NDT results allow an inspector or surveyor to determine whether a detected anomaly is a manufacturing defect or

the result of a lightning strike.)

Dexmet Corporation's (Wallingford, Connecticut) MicroGrid is an expanded metal mesh employed in exterior aircraft composites, applied near the surface of the laminate schedule. It has a proven record of lightning-strike protection; it yields easy-to-see strike damage in aircraft and on wind-generator blades; and it provides shielding from electromagnetic and radio-frequency interference. As Dexmet's Brett MacDonald explained, "When a lightning strike does occur, because the metal



COURTESY DEXMET (BOTH)

Left—To protect underlying carbon fiber laminates and to reveal where lightning-strike damage has occurred on aircraft, Dexmet Corp. adds a very thin layer of aluminum MicroGrid—increasing laminate thickness by just 0.015" (0.381mm)—on some cored-composite panels. **Right**—Because the metal mesh is more conductive than the carbon fiber, lightning-strike damage is localized and easy to spot in this sample.

mesh is more conductive than the underlying carbon layers, the damage is readily visible at the part's surface, allowing simple eyeball inspection." He added, "The mesh does need to be connected to a traditional conductive bonding strap."

To prevent print-through of the mesh texture, he advised including a thin layer of chopped strand mat or sheet adhesive. The MicroGrid itself adds very little thickness to the finished laminate. MacDonald: "After the

mesh is expanded, it is flattened by a run through calendar rolls, so laminate thickness is minimally increased, generally less than 0.015" [0.381mm]."

Corrosion has caused more than a few unexpected problems in untreated aluminum honeycomb cores in boat hulls and decks, but MacDonald says MicroGrid can be treated to better withstand the perils of the marine environment. "We have encountered these corrosive conditions in offshore wind-farm applications, where the

aluminum mesh is typically treated with phosphoric acid and then anodized. Dexmet recommends temperature- and humidity-controlled storage for the mesh to prevent oxidation before the products are encapsulated in the laminate stack."

Dexmet's website, www.dexmet.com, lists the properties of the wide range of expanded metal products it manufactures, and includes a well-illustrated technical paper on lightning strike damage to carbon composites.

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