The feasibility of the light-curing tapes was demonstrated in experiments in which tapes were made from fiber-glass fabric impregnated, variously, with (1) cationic epoxy resins plus a sensitizer that preferentially absorbs light at a wavelength of 380 nm, (2) free-radical curing acrylate resins, or (3) blends of resins of both types. Methods of incorporating adducts into the epoxies to tailor their viscosities were developed. The tapes were applied to aluminum and carbon/epoxy composite substrates that had been prepared by sanding and wiping with alcohol. The resins were cured by 380-nm light from LEDs. The blends of resins of both types were found to be advantageous in that during exposure to the light, their acrylate components contributed rapid buildup of strength, while their epoxy components contributed adhesion and longer-term strength.

Poly(ethylene terephthalate) backing films were shown to pass the needed 380-nm light and, when prepared with corona treatment, to adhere well as parts of cured tapes. Peel tests confirmed generally high degrees of adhesion to aluminum substrates. Demonstrations of repairs were made, including bonding pipes of various materials together, patching burst pipes, and patching punctures. A 1-in. (2.54-cm) patch over a 1/2-in. (1.27-cm)-diometer hole was pressurized to 120 psi (≈0.83 MPa) without failure or delamination.

This work was done by Ronald Allred and Andrae Hoyt of Adherent Technologies, Inc. for Marshall Space Flight Center. For further information, contact Sammy Nabors, M SFC Commercialization Assistance Lead, at sammy.a.nabors@nasa.gov. Refer to MFS-32532-1.