Fibrillized Aramid Fibers for Improved Bonding with Matrix Materials

Technology #2019-012

Aramid fiber (aka Kevlar®, Nomex®) reinforced composites are materials with excellent potential for application in next generation aircraft, wind turbines, personal protection, and other high specific strength applications. However, thus far their utilization has been limited by poor bonding between the fiber and the matrix material, which leads to weak interfaces and failure by delamination. Past approaches to address this limitation have disadvantageously weakened the fiber core and dramatically reduced the tensile strength of the material.

Improved matrix bonding by gently roughening the aramid fiber surface

The available technology is an innovative methodology for improving aramid fiber bonding to the polymer matrix within advanced composite materials without adversely affecting tensile strength. This is accomplished by gently roughening the surface of the aramid fiber, which results in improved mechanical interlocking between the fiber surface and bulk matrix polymer. Importantly, physical characterization of prototype materials demonstrates that this approach is capable of generating composites with dramatically improved interfacial bonding strength without any significant reduction in the tensile strength of the material. The process is conducted on a relatively short timescale and only requires the use of low-cost reagents and supplies.

Applications

- Defense and personal protection applications in the form of new materials for products like body armor, flame-resistant apparel, and vehicle armor
- Advanced composites for the aeronautical sector that provide enhanced strength and durability while simultaneously reducing the weight of aircraft
- Automotive composites that will offer improved safety profiles and reduced vehicle weight, leading to improved fuel economies
- Next-generation wind turbines with significantly longer blades that generate greater power output more efficiently

Advantages

- Improved interfacial shear strength without decreasing tensile strength
- Improved fiber-matrix delamination
- Scalable production process: short processing times, very low cost reagents
Inventors

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