Materials & Chemicals

3D-PRINTED FERROELECTRIC METAMATERIAL WITH GIANT PIEZOELECTRICITY AND BIOMIMETIC MECHANICAL TOUGHNESS

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Inventors: Xudong Wang, Jun Li

The Invention

UW-Madison researchers have developed a nacre-mimetic ferroelectric metamaterial with exceptional piezoelectricity and fracture toughness. Ferroelectric (e.g. poly(vinylidene fluoride)-co-hexafluoropropylene/lithium-doped sodium potassium niobate (PVDF-HFP/Li-KNN)) and conductive (e.g. polylactic acid/carbon black (PLA/CB)) composites were developed, mimicking the soft bio-adhesive and tough aragonites in nacre, respectively, as the building blocks to construct a lamellar heterostructure. The interdigitated configuration and uniform quality among layers enabled effective accumulation of piezoelectric charges from each layer. A piezoelectric coefficient of over 130 pC/N was achieved from the as-printed 3D structure, reaching the same level as piezoceramics. The nacre-mimetic structure together with the strong interfacial adhesion brings high resistance to crack propagation, leading to a high fracture toughness exceeding most natural and synthetic piezoelectric materials. Based on this structure, full-sized biomimetic piezoelectric bones were created with anisotropic piezoelectricity, strong toughness, and tunable modulus.

Additional Information

For More Information About the Inventors

- Xudong Wang

Tech Fields

- Materials & Chemicals : Composites

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867