TECH OFFER

MXene Fibers and Functional Textiles

KEY INFORMATION

TECHNOLOGY CATEGORY:
Manufacturing - Chemical Processes
Chemicals - Inorganic
Materials - Semiconductors

TECHNOLOGY READINESS LEVEL (TRL): TRL4
COUNTRY: SINGAPORE
ID NUMBER: TO174926

OVERVIEW

MXene fibers are a new class of functional fibers that have been shown to have excellent electrical, electrochemical, and mechanical properties. Fabricated from electrically conductive and mechanically strong MXene nanosheets, these fibers cater to the growing demand for advanced materials in the field of textile-based devices and beyond. However, achieving a harmonious balance between electrical conductivity and mechanical properties remains a significant challenge in fully harnessing the potential of MXene fibers. This challenge primarily stems from the difficulties encountered in compacting the loose MXene nanosheets further.

This technology presents a continuous and controllable approach to fabricate highly compact MXene fibers. The resulting MXene fibers exhibit exceptional compactness, with high orientation and low porosity, thereby demonstrating outstanding tensile strength, remarkable toughness, and superior electrical conductivity. Moreover, these ultra-compact fibers are constructed into meter-scale MXene textiles, which showcase high-performance electromagnetic interference shielding and personalized thermal

management capabilities. These MXene textiles also exhibit exceptional mechanical durability and stability, even after undergoing multiple washing cycles. The technology can be readily extended to a wide range of nanostructured materials, enabling the construction of functional fibers for large-scale applications in various domains, including both space and everyday life.

The technology owner is interested in joint R&D projects and out-licensing opportunities with companies who require high performance functional fibers.

TECHNOLOGY FEATURES & SPECIFICATIONS

The technology is a continuous and controllable wet-spinning process to fabricate ultra-compact MXene fibers, making it highly suitable for scale-up production of electronic textiles.

The resultant MXene fibers exhibit the following characteristics:

- High tensile strength (585.5 ± 2.1 MPa)
- Ultra-high toughness (66.7 ± 5.0 MJ m-3)
- High electrical conductivity (8,802.4 ± 30.8 S cm-1)
- Excellent long-term mechanical durability and stability (~87.8% performance retention after 5×104 bending cycles)
- Suitable for electromagnetic interference (EMI) shielding (~57 dB) and thermal management applications (After applying voltages of 8 V, MXene fibers can generate the heat with the temperature increasing up to ~130 °C.)

This technology can be applied to a diverse range of nanostructured materials, such as graphene fibers, carbon nanotube fibers, and carbon fibers. This opens possibilities for the construction of functional fibers with wide-ranging applications in various domains.

POTENTIAL APPLICATIONS

Potential applications of the ultra-compact MXene fibers include (but not limited to):

- EMI shielding
- Personal thermal management
- Energy storage
- Wearable electronics
- Healthcare
- Aerospace

UNIQUE VALUE PROPOSITION

- Ultra-compact MXene layers formed, resulting in fibers that exhibit good performance such as high electrical conductivity, strength, and toughness
- Continuous and controllable route that enables scale-up production of electronic textiles

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