Spring 2025 OVPR Seed Grant Program

Proposal Title: Fundamental Studies on Bimetallic Conductive MOF-Textile Composites for Chemical Protection Applications

I. Abstract: This proposal aims to establish a transformative materials platform by developing and characterizing bimetallic conductive metal-organic framework (MOF)-textile composites for advanced chemical protection. The project builds on our recent success in integrating high-aspect-ratio $Cu_3(HHTP)_2$ nanowires onto chemically inert polypropylene (PP) fibers via a hydroxy double salt (HDS)-mediated, aqueous-phase route conducted under mild (<50 °C) conditions, an approach that overcomes key challenges in MOF-textile integration.

The proposed work introduces the use of compositionally programmable bimetallic HDS intermediates, enabling the controlled growth of bimetallic conductive MOFs with tunable electrical and catalytic properties. Despite the promise of such materials, a systematic and scalable strategy for integrating bimetallic c-MOFs onto polymeric textiles has not been rigorously explored, leaving a critical gap in both fundamental understanding and practical deployment.

The resulting composites are designed for dual-functionality, capable of adsorbing and catalytically degrading hazardous chemicals, including toxic industrial chemicals (e.g., NH_3 and H_2S) and chemical warfare agent simulants (e.g., paraoxon-methyl and 2-chloroethyl ethyl sulfide). The project will generate essential insights into structure-property-function relationships, paving the way for scalable production of next-generation smart chemical barrier materials that align with pressing national defense needs.

1