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RE:
Review on research of Dana Kanzhigitova toward doctoral dissertation

Dear members of the committee,

it is my pleasure to provide a review of Dana Kanzhigitova's dissertation work, which is presented as a series of articles.

Her first paper, "Strategic Synthesis of 2D and 3D Conducting Polymers and Derived Nanocomposites," was published in *Advanced Materials*. This study investigated how four different bicontinuous microemulsion systems affected the shape of a conducting polymer. The systematic use of a bicontinuous microemulsion system without and with different surfactants allows for the preparation of conducting polymer nanocomposites in a controlled environment, allowing for fine manipulation of the material's characteristics and design. The system's connected oil and water phases create a large interfacial area, allowing for effective mass transfer and interactions between the components, resulting in increased electrical conductivity. The system with the highest conductivity had a value of 219 S/cm, much higher than for previously reported similar 2D materials. The article is well-written and informative about the synthesis and prospective applications of conducting polymer nanocomposites.

In her second research, published in *Advanced Composites and Hybrid Materials*, Dana Kanzhigitova studied the charge transfer properties of the resulting electrically conductive polymers to explain the composites' better hydrogen gas sensing properties. To improve sensing performance, the carrier mobility and concentration, as well as the arranged structures of polymer chains, were investigated. The study provides insight into the fabrication of highly sensitive hydrogen sensors based on a hybrid thin film of vanadium pentoxide and polypyrrole. The findings of the study have important implications for the development of gas sensing systems for a wide range of industrial and environmental applications.

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Her third paper, "Controlled Synthesis of Polyaniline-Based Nanomaterials with Self-Assembly and Interface-Manipulation", which was recently published in *Langmuir* reports on the controlled synthesis of polyaniline-based nanomaterials by self-assembly and interface manipulation methods. The authors emphasize the unique qualities of conducting polymer nanostructures, such as their electrical, optical, and thermal properties, and describe their potential uses in a variety of applications, including medicine, energy storage, and adhesive materials.

Overall, the research of Dana Kanzhigitova has made original and relevant contributions to materials science and engineering, and provides a profound basis for a doctoral dissertation.

Sincerely,

Prof. Dr. Mathias Ulbricht

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