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ABSTRACT:

Modification of the Nanoscale Structure and Surface Morphology of Polyvinyl Alcohol Films Upon Glycerol and Chitosan Incorporation

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Polyvinyl alcohol (PVA)-based films, often blended with chitosan and plasticizers such as glycerol, are widely investigated for applications in biomedical and packaging, due to their tunable physicochemical properties. This work integrates insights from Atomic Force Microscopy (AFM) imaging, X-ray Diffraction, Infrared Spectroscopy and Thermal Analysis to elucidate the effects of glycerol and chitosan incorporation on the morphology, crystallinity and thermal properties of PVA.

Utilizing advanced scanning probe microscopy techniques such as ultrasonic force microscopy (UFM) and lateral force microscopy (LFM), nanoscale ribbon-shaped crystalline domains were identified in pure PVA films. The addition of glycerol transformed these domains into rounded structures, corresponding to changes in crystallinity and thermal properties [1]. The presence of glycerol reduces crystallinity, modifying the polymer matrix by disrupting hydrogen bonding interactions, leading to a more amorphous structure. On PVA/Chitosan blends UFM and LFM revealed the presence of distinct softer lower-friction regions, possibly related to the formation of a new different phase as a result of PVA-chitosan interactions [2].

These findings contribute to the optimization of PVA-based hybrid materials, offering valuable insights for tailoring their properties in biomedical coatings, flexible electronics, and biodegradable packaging applications.

[1] G. Kovtun, D. Casas, T. Cuberes, Polymers 16, 2421 (2024).

[2] G. Kovtun, D. Casas and T. Cuberes, 2024 IEEE 42nd International Conference on Electronics and Nanotechnology (ELNANO), Kyiv, Ukraine, pp. 261-265 (2024)