Different approaches for nanocomposite characterization: the role of organization of the nanoparticles

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Dispergation of nanoparticles in a polymer matrix is a key task in the preparation of nanocomposites. Atomic force microscopy (AFM) can be used for the detection of the homogeneity of the nanoparticle distribution, assessing the quality of their dispersion inside the bulk material or on its surface as well as checking that the incorporation procedure has a minimal impact on the morphology of the nanoparticles. In this study, we focused on the comparison of several types of nanoparticles, i.e. (1) in situ-prepared fully oriented layers, (2) nanolayers having a house-of-card architecture in the matrix and (3) randomly or oriented nanolayers in the matrix. The shape and the size of the primary nanoparticles were characterized after spin-coating of their dispersion in the solvent as well as in a matrix with the identical dispergation method as used for the nanocomposite. The results are compared to the cut and surface of the nanocomposite.
The comparison of the fully oriented nanocomposite (layered chalcogenides prepared by a photo-induced solid-state reaction of chalcogenides [1]), non-reactive nanomaterials (calcium phenylphosponate [2]) and tunable polyborazylene (the size and reactivity are changed by the annealing [3]) enables the illustration of different approaches of the preparation of the samples, AFM measurement modes and necessity of other characterization techniques (BET, spectroscopies, etc.).

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References

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[2] K. Kopecká, L. Vítková, Z. Kroneková, L. Musilová, P. Smolka, F. Mikulka, K. Melánová, P. Knotek, M. Humeník, A. Minařík, A. Mráček, Biomacromolecules (2023) in press.
[3] to be published.

Figure

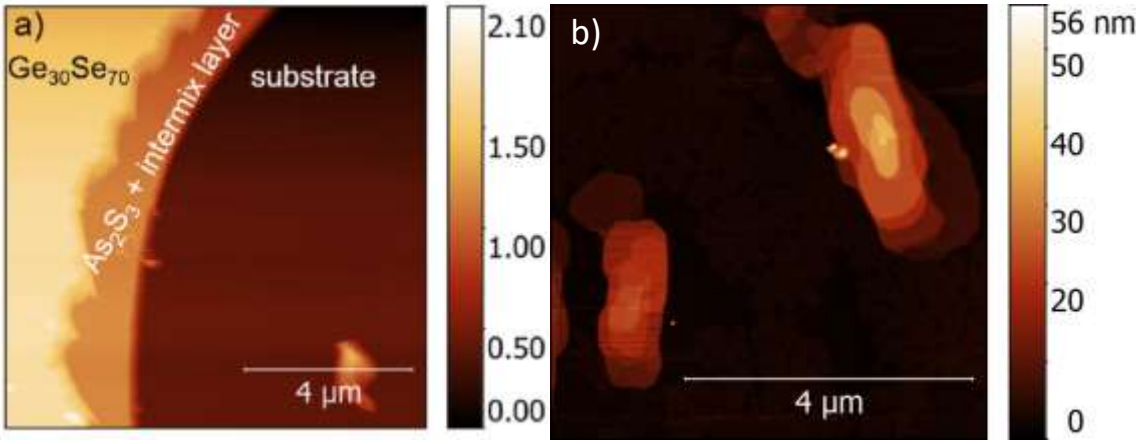

Figure 1: The illustration of the sandwich-like chalcogenide thin film formed by the solid-state reaction (a) and polyborazylene (annealed at the 700°C) on the substrate (b)