New strategies of the hybridized carbyne-based nano-matrix spatially controlled growth during ion-assisted pulse-plasma deposition

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Structural self-organizing and pattern formation are universal and key phenomena observed during growth and cluster-assembling of the carbon-based nanostructures at the ion-assisted pulse-plasma deposition. Fine tuning these universal phenomena opens access to the properties of the growing nano-matrix. Taking into account that the sp1-bonds are formed only in a narrow range of optimal ion-assisted pulse-plasma deposition parameters, we consider the new strategies and technological tool-kit of the hybridized two-dimensional ordered linear-chain carbon nano-matrix spatially controlled growth and self-assembly. In particular, we propose combined application of the ultrasonic standing wave technology, which creates an acoustic hologram in the growth area and wirelessly powered discharge-induced electrokinetic phenomenon of the nano-matrix self-assembly. Existence of such phenomena was experimentally confirmed through the model experimental systems. We consider the influence of the acoustic waves frequency and oscillating electromagnetic field on the nano-matrix structure. We analyze the dependence of the nanostructures self-organization and self-synchronization phenomena from the ion-assisted pulse-plasma deposition parameters. We propose the data-driven carbon-based nanomaterials genome approach that is a new data-driven strategy for designing of the new carbon-based nanomaterials and forecasting of their properties. The reported study was funded by RFBR and TUBITAK according to the research project No. 20-58-46014.