Limitations create opportunities: solving paradoxes in organic semiconductor and biomolecular self-assembly via nanoconfinement effects

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Abstract
When liquids are confined between suspended particles at the nanoscale, properties change and new phenomena become dominant. This has significant effects on both the confining particles and the dissolved molecules within the confined liquids.

In this talk two examples of such effects will be presented. In the first part an effect is shown that we call "o*rganic solid/solid wetting*".[1] This effect induces the growth of 2D supramolecular crystals on surfaces directly from insoluble 3D particles. The seemingly paradoxical effect is based on phenomena that occur in correlated fluids that are nanoconfined between suspended particles. This allows, for example, surface transfer doping of graphene via insoluble organic pigments with very low technical effort and energy consumption. In the second part, the abiotic synthesis of RNA, classically not possible within water, is demonstrated to occur within nano-confined water between suspended nanoparticles,[2] thus solving a nagging paradox in prebiotic chemistry.

The exploitation of nanoconfinement effects in correlated fluids opens up new avenues for approaches in sustainable chemistry to the fabrication of organic semiconductor devices. It also enables abiotic polymerisation of key building blocks of life into complex macromolecules under ambient conditions, providing insights into key steps in the chemical evolution towards the origin of life.

References:
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