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Curvature effects on the stability of lipid bicontinuous cubic phase films interacting with gold nanoparticles

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Non-lamellar lipid membranes are highly relevant in lots of biological processes like exo/endocytosis, and cell division; an interesting case is represented by inverse bicontinuous cubic phase membranes. By designing biologically inspired synthetic bicontinuous cubic phase membranes, it is possible to exploit the amphiphilic nature of their lipid components to encapsulate hydrophobic, hydrophilic and bioactive nanoparticles (NPs) (Nanoscale,2018,10,3480-3488; JCIS 541(2019):329-338). This feature makes them promising candidates as matrices for biosensing applications and the development of NPs-based therapeutic systems. Differently from the case of flat lamellar membranes (J.Microscopy,Ridolfi A.,2020), the interaction of NPs with highly curved cubic membranes has not been extensively addressed yet. We herein present a Neutron Reflectivity (NR) and Grazing Incidence Small Angle Neutron Scattering (GISANS) study on the different structural effects produced by AuNPs of different shapes, when interacting with both cubic and lamellar lipid films. We investigate how variations in the curvatures of both the lipid matrix (lamellar versus cubic phase) and AuNPs (spherical versus rods) influence the stability of the film architecture and the NPs interaction kinetics. In particular, we found that cubic phase films display an increased stability against AuNPs injection compared to lamellar phase films while rod-like AuNPs possess a more disruptive effect compared to the spherical ones.

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