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FORMATION OF GOLD NANOPARTICLES UNDER A MONOLAYER OF IONIC LIQUID

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The use of an ionic liquid (IL) as electrolyte is promising for very high capacity energy storage units based on graphene electrode [1]. Moreover, introducing gold nanoparticles (NPs) at the interface between the IL and the electrode makes it possible to increase the capacitance [2]. We study the interface between these NPs and a layer of the [C20mim]+[NTf2]- IL. We use x-rays surface radiolysis [3] to produce gold NPs under a Langmuir film of [C20mim]+[NTf2]- deposited on an aqueous sub-phase containing gold ions [4]. The formation of gold NPs is obtained by irradiating the surface with the x-rays which simultaneously allows in following their growth and the structural transformations in the film. The films characterization was carried out on the liquid sub-phase by thermodynamic (surface pressure versus surface density isotherms), surface x-rays scattering measurements at the SOLEIL synchrotron and AFM measurements on films transferred on solid substrates before and after irradiation. We observe that both the film thickness and r, the gold ion/IL molecule ratio, are key factors for the formation of the gold NPs: at a low ratio (r = 30), gold NPs of about 15 nm in diameter are obtained. On the other hand, for a high ratio (r = 600), we observe the appearance of a superstructure in the monolayer but no formation of NPs. The exchange between AuCl4- (in the subphase) and +[NTf2]- appears to be the element preventing the possibility of forming gold NPs anchored under the layer [5].

References
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