Direct Deep UV (DUV) photopatterning of metal oxide thin films from nanocrystal (NCs) colloids: a simpler and faster process at room temperature

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Deep UV photolithography (193 nm) is a reference technique for micro/nanopatterning. The photoresists used, which are exclusively organic, have only a sacrificial role and do not contribute to the final properties of the material. This also adds a significant number of steps and the use of corrosive products in the process. In the case of metal oxides, several studies have already made it possible to considerably reduce the number of steps by directly structuring the material using hybrid photoresists [1, 2]. The produced oxide is however amorphous and a high-temperature annealing step is necessary to obtain the crystalline phase, ruling out the application to flexible substrates. A possible solution is to start directly from the oxide in the form of NCs and to assemble them. This approach has already been successfully tested in the case of quantum dots (CdS, CdSe) and for micrometric resolutions [3] but always involving toxic products. The objective is to propose an original direct nanopatterning approach using colloidal NCs as "building blocks" that assemble under the effect of DUV light, while being more environmentally friendly (abundance, toxicity).

Using FTIR and XPS spectrocopies, ellispsometry and XRD characterizations, it has been observed that the assembly of NCs results from a spatially controlled aggregation following the degradation of ligands on the surface without modification in size of the NCs (**Fig. 1**). The study focuses mainly on ZnO but the wide variety of oxides that can be synthesised in the form of NCs encourages a generalisation of the process to other oxides.

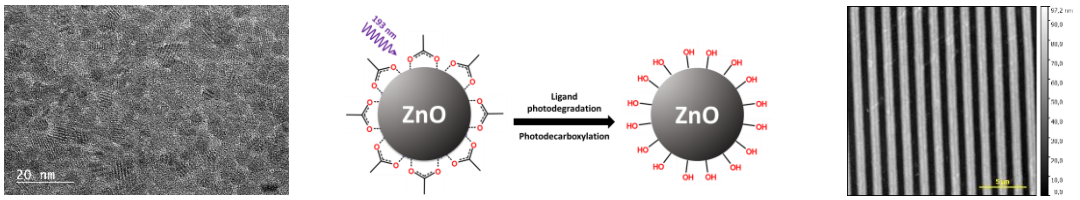

Figure 1 : **From colloids to microstructures by ligand photodegradation under DUV exposure.**

References

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