Micro and nanopatterning of Metal Oxo-Cluster photoresists

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Metal Oxo-Cluster (MOC) based photoresists have emerging as a very interesting alternative material platform for the next generations of photolithography. The sol-gel chemistry to generate them is very versatile, the building blocks are of nanometer scale size, allowing nanoscale patterning and these MOC precursors can be easily transformed by light or heat into metal oxide. Not only metal oxide micro and nanostructures are useful as mask for etching but also, the metal oxide nanostructures can be directly used in devices like nanogenerators, gas sensors, biosensors, photodetectors, spintronic devices, and field-effect transistors.

We describe in this study the synthesis, characterization and DUV photolithography of MOC photoresists, based on Zr, Ti, Hf and Zn. A deep investigation of the photoinduced modification of the MOC is carried out by spectroscopic ellipsometry, FTIR, Raman, XPS, in order to describe how the MOC photoresist is crosslinked and have thus a negative tone behavior. We also investigated the photopatterning of these photoresists by DUV interferometric lithography.

Finally, electrical properties of amorphous metal oxide nanopatterns are investigated, which opens doors towards applications in sensing.

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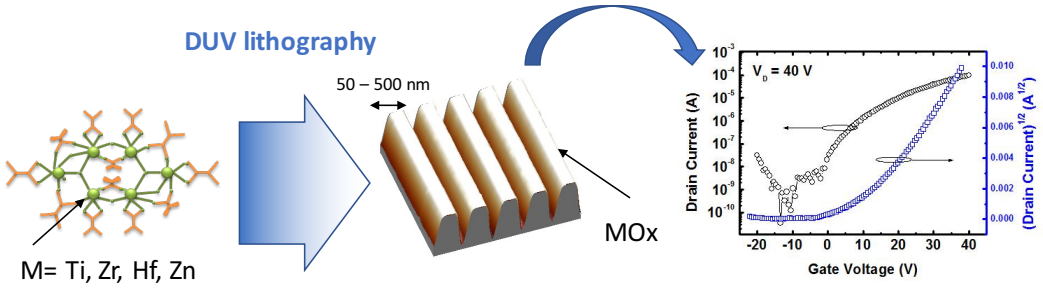

Figure : Schematic view of MOC clusters; AFM images of patterns with typ. width between 50 and 500 nmand thickness of few tens of nm ; illustration of semi-conducting properties of the DUV patterned material.