Highly electrical conductive, ultralarge and well-ordered MMX nanorods

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Infinite structures based on the combination of metals and organic/inorganic ligands by coordination bonds, are known as coordination polymers (CPs). These materials show a rich structural diversity and interesting physic-chemical properties, including electrical conductivity [1, 2].

A novel approach in the search of nanomaterials is the organization of CPs on surfaces with potential technological applications, such as nanoelectronics [3]

For this reason, one of the main interests is the formation of electrical conductive 1D nanostructures potentially suitable as molecular wires for the construction of nanocircuits [4]

A particular type of CPs called MMX polymers seems to be particularly attractives [5]. A MMX polymer [1] consists of 1D sequence of halides (X) bridging dimetallic (MM) subunits in which metal ions are connected by organic ligands.

Here we present electrically conductive fibers of the MMX polymer $[Pt_2 I (S_2CCH_3)_4]_n$ adsorbed on a SiO_2 surface that we characterize by Atomic Force Microscopy (AFM).

The well-ordered 1D nanostructures have been isolated on the surface by direct sublimation from monocrystals of $[Pt_2I(S_2CCH_3)_4]_n$. The approach involves the deposition from vapor phase on a substrate of mono or oligomeric species obtained by sublimation of a bulk MMX under high vacuum and their self-organization on the host surface. The advances made in the several parameters that affect the organization experiment of these systems have enabled us to optimize the morphology respect to [5] and obtain longer fibers, with an average length of 8-10 µm and height 10-30 nm. Importantly, we observed a conductance improve of a factor of 100-1000, reaching values in the same order of magnitude to those measured in the macroscopic crystals [6].
We attribute this increment in the conductance to a lower density of defects in the nanorods and put into perspective the importance of the deposition conditions to obtain nanocrystals with high degree of structural perfection.

As shown in Fig.2, we have used Conductance Atomic Force Microscopy (C-AFM) to characterize the electrical transport properties of the nanomaterials at room temperature.
Further, electrical characterization by three terminal measurements in Field Effect Transistor configuration is currently in progress.

These results confirm CPs as excellent candidates for applications in molecular electronics.

References

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Figures

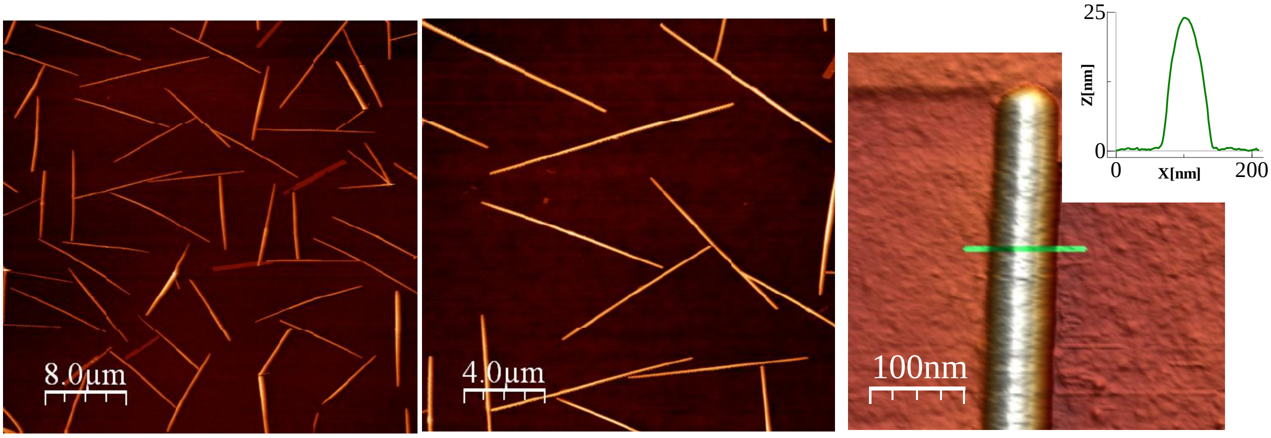

Fig.1 AFM topographies of the isolated nanorods on SiO_2 and 3D image of one nanorod and its height profile.

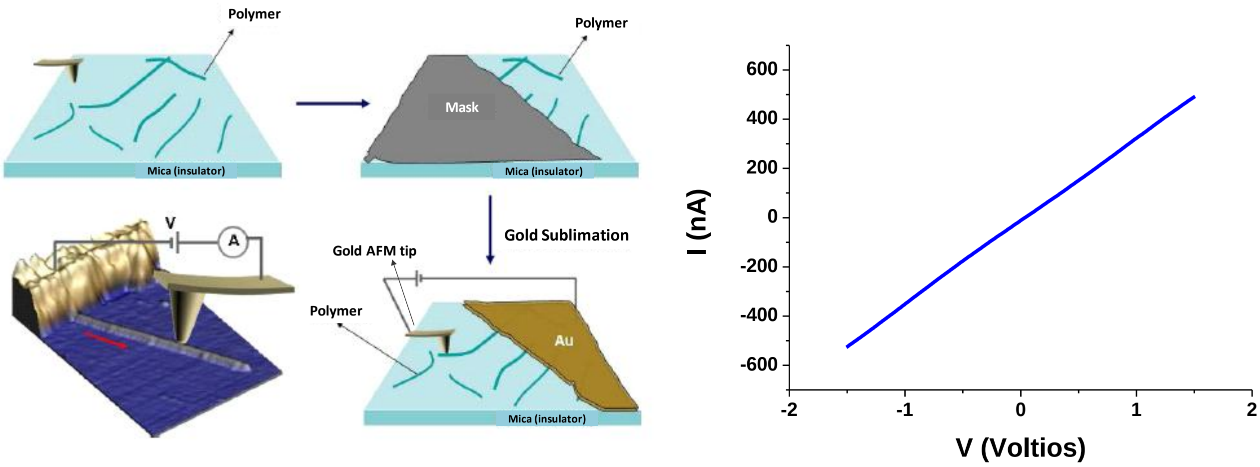

Fig.2 a) Schematic representation of the procedure used to perform electrical measurements on the MMX nanorods using the C-AFM technique in horizontal geometry. **b)** Example of current versus voltage characteristic curve taken by contacting a fiber 100 nm from the gold electrode**.**