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Metal-organic platforms for photonic applications based on poly-10,12 dicosadiynedioic acid (PDCDA)

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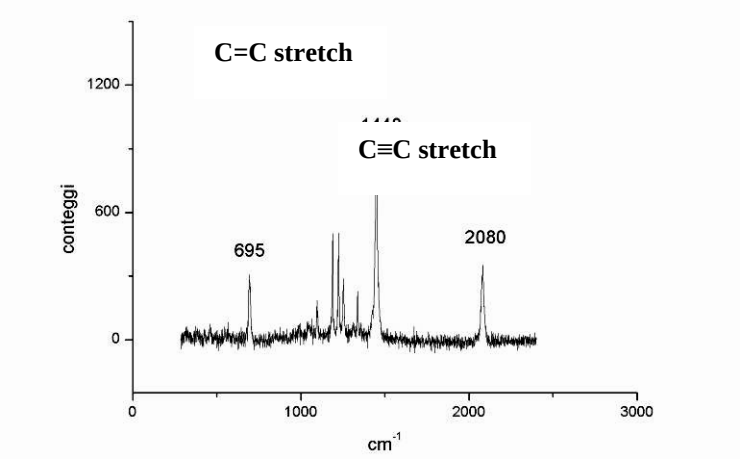
The modification of metal surfaces with monolayers of polydiacetylenes (PDAs) or with PDAs-based nanohybrids [1] is a subject of great interest, in particular for applications in nonlinear optics, sensing [1,2] nanolithography and nanophotonics.

For the functionalization of metal we have chosen the 10,12 dicosadiynedioic (DCDA) monomer for the following reasons. First, the presence of a symmetric COOH functionality makes it possible to use either of the DCDA terminals as linker to a surface, while the other one is free to interact with other molecules or other metal surfaces. Second, the absence of cumbersome lateral moieties enables the polymerization in the more conjugated form, highly desirable for nonlinear optical applications.

In this work, we report on the realization of metal-organic surfaces via functionalization of a planar Ag surface through 1) Self Assembly (SA) of a molecular monolayer of DCDA, and 2) SA of a layer of Ag–DCDA capped particles. The functionalization is followed in both cases by the UV polymerization of the monomeric units.

The formation of a self-assembled monolayer (SAM) of DCDA on the flat Ag surface and the UV polymerization are *in-situ* monitored via Surface Plasmon Resonance Spectroscopy (SPRS). The polymerization process is confirmed by Surface Enhanced Raman Scattering (SERS) measurements (see figure below).



The DCDA-capped nanoparticles used for the second step have been chemically synthetized, their water dispersion has been analyzed by UV-vis extinction spectroscopy and their shapes and dimensions were investigated by electron microscopy. The SA of these particles on the Ag surface was *in-situ* monitored by SPRS. After UV irradiation of the surface the final product, a metal-polymer composite, is obtained and analyzed by SERS spectroscopy. In both cases, a bluish-green PDCDA is formed, that results to be quite stable even after prolonged UV irradiation.

[1] M. Alloisio, A. Demartini, C. Cuniberti, G. Dellepiane, Sensor Letters, (2010), in press.
[2] T. Kim, R. M. Crooks. Tethraedron Lett., 35 (1994) 9501