From molecules to nanomaterials

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When simple molecules, such as metal-sandwich complexes or coordination compounds are introduced into polymers, various materials with exciting properties can be obtained.

The synthesis of new gold, silver and palladium nanoparticles reduced and in parallel encapsulated from metallopolymers and metallodendrimers with transition metal-sandwich molecules (i.e. iron and cobalt) leads to highly specific and well-defined architectures, like nanonetworks[1-3] and nanocapsules[4]. Promising applications such as electrochemically induced derivatization of electrodes, molecular recognition and redox sensing, electrochromics with multiple colours, generation of metal nanoparticles of various size and their use for nanocatalysis towards depollution and biomedicine have therefore emerged. In the same line when coordination spin-crossover compounds are introduced in the polymer matrix development of synergies between the properties of the matrix and the inorganic load gives the green light for polymer composite devices for applications in the fields of artificial muscles, energy harvesting and thermochromic sensing[5]. This supramolecular engineering opens the way towards the application of organometallic/inorganic chemistry in the design of new 'structured' nanoparticle-containing nanomaterials using the redox properties of metallomacromolecules.

The design of two-dimensional (2D) polymers[6-8] with strong coordination motifs for Cu (II), Pd (II), Au (III) and Pt (II) , will be also described, representing the next step towards a more controlled and ordered architecture of metal nanoparticles offering advantageous potentials in sensing, catalysis, mechanical strength and conductivity.

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