

ONE-DIMENSIONAL METAL-AMINOACID AND METAL-PEPTIDE NANOSTRUCTURES AND THEIR USE AS TEMPLATES FOR INORGANIC NANOPARTICLE SUPERSTRUCTURE SYNTHESIS

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Extended metal-organic networks built up from the combination of organic and inorganic building blocks are among the most attractive materials today. Because of their vast compositional and structural versatility, these materials show promise for a myriad of applications, such as gas sorption, storage, catalysis, separation and magnetism. At the nanoscale, these materials can show size-dependent properties which, if properly exploited, may expand the scope of these materials in numerous practical applications, including drug-delivery, contrast agents, sensor technology, scaffolds, electronics, functional membranes and thin-films.

Many potential applications of these metal-organic materials may require them to be constructed from benign building blocks that are biologically and environmentally compatible. Recently, biomolecules have emerged as building blocks for constructing extended metal-biomolecule networks.¹ Biomolecules such as aminoacids and peptides offer several advantages as organic building blocks because they are readily and naturally available in quantities and at prices amenable to preparing bulk quantities of materials; they can lead to biologically-compatible materials; they are structurally diverse; they can have many different metal-binding sites, and consequently, they can exhibit multiple possible coordination modes, a feature that increases the potential structural diversity of these materials; they have intrinsic self-assembly properties which can be used to direct the structure and function of the resulting materials; and they are chiral.

In this communication, we will show our latest advances in the development of new synthetic methodologies that enable the self-assembly of metal ions and aminoacids and peptides into one-dimensional (1-D) nanostructures.^{2,3} These novel methods include fast precipitation, diffusion and specially microfluidic technologies. The resulting nanofibers, nanowires and nanobelts made of aminoacids (e.g. aspartic acid and cysteine) and peptides incorporate the intrinsic characteristics of these biomolecules, such as their selective recognition and chirality. Furthermore, because of the recognition capacities, we will show how these metal-biomolecule nanostructures can be used as dual biotemplates to form sophisticated self-assembled inorganic nanoparticle superstructures, such as bimetallic 1-D superstructures made of Fe₃O₄ and Ag nanoparticles that marry the magnetic and conductive properties of the two nanoparticle types.

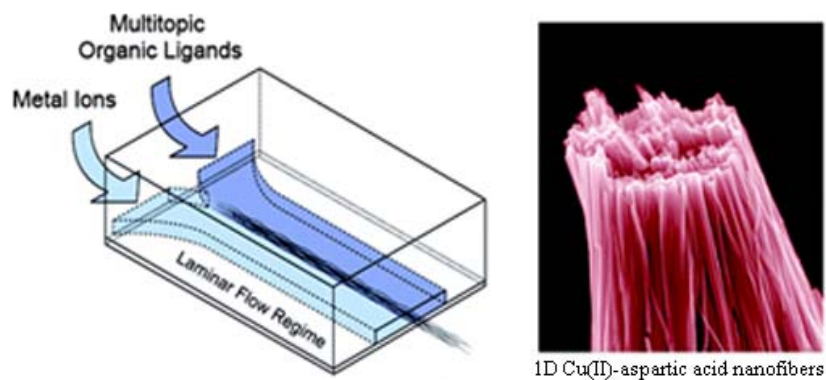


Figure 1. (Left) Schematic illustration of the formation of metal-aminoacid nanofibers using microfluidics. (Right) Representative SEM image of Cu(II)-aspartic acid nanofibers.

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