Surface Modification of Self-Assembled Nanotubes from Amino Acid Amphiphiles in Solution

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Nanotubes with a well-defined radius can be formed by self-assembly of amino acid amphiphiles (AAAs, short synthetic peptides generated from amino acids and fatty acids). The AAA $C_{12}KC_{12}K\text{-}NH_2$ self-assembles into stable nanotubes of great length of several µm and a diameter of 70-120 nm by progressing from long thin fibers via twisted and helically coiled ribbons to nanotubes [1,2].

Such AAA nanotubes can be used as templates to produce multi-layered nanotubes. These can be produced by subsequent deposition of oppositely charged materials, e.g. polyelectrolytes, on the nanotube surface by applying the layer-by-layer (LbL) technique [3] or coating them with metals by surface reduction [4]. We coat the nanotubes using different polyelectrolytes and metals in aqueous solution and study nanotube structure and subsequent changes. By combining different techniques like scattering methods (SLS/DLS, SANS, SAXS), AFM and direct-imaging methods (cryo- and dry TEM, SEM) a comprehensive understanding of structural details of the modified nanotubes can be gained with pH and surface charge as the expected major control parameters. These modifications yield hybrid nanotubes with potentially adjustable properties rendering these systems much more versatile for employment in future applications, e.g. in delivery systems and as smart materials.

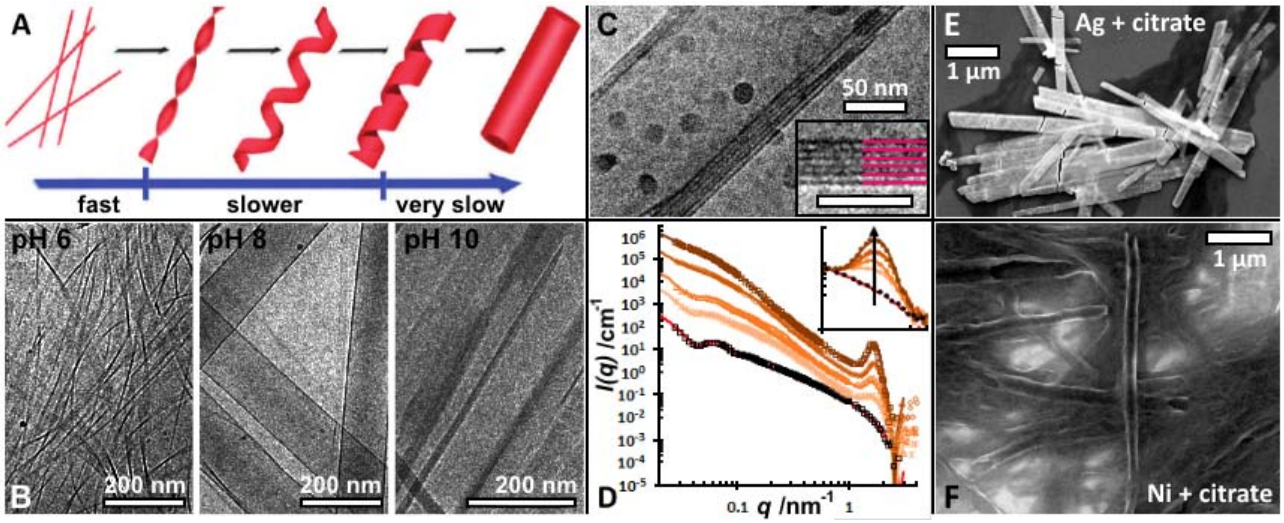

Figure 1. Self-assembly of $C_{12}KC_{12}K\text{-}NH_2$ in aqueous solution, A: Schematic illustration of self-assembly route [from 2], B: Cryo-TEM of self-assembled structures, C: Cryo-TEM of multi-layered LbL-modified nanotube, D: Neutron scattering curves of LbL-modified nanotubes, E: SEM of silver-coated nanotubes reduced with citric acid, E: SEM of nickel-coated nanotubes reduced with citric acid.

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