

NANOFABRICATION WITH PEPTIDE AND PROTEIN TUBES*Alexander Bittner**Asociacion CIC nanoGUNE, Tolosa Hiribidea, 76, 20018 Donostia - San Sebastian, Spain
a.bittner@nanogune.eu*

Tubular structures can be obtained in various elegant ways. Electrospinning is the electrostatic formation of thin fibers from viscous polymer solutions. Employing self-assembling monomers such as phospholipids and proteins is a novel route, which we extended to short peptides. [1] Aromatic residues in the peptides cause pi-stacking of the molecules, and together with the electrostatic interactions (peptides are zwitterions) fiber and tube formation is induced. On the macroscale, electrospun tubes usually coil up in an irregular mesh-like structure (Fig 1). We show that a collector with sharp edges can lead to alignment and suspended structures (Fig 2). Based on the chemical variability of peptide tubes, we plan to develop a new setup for experiments on nanofluidics.

Nature, too, has developed some very efficient tube formation strategies. One of the uses of protein tubes is to protect and transport RNA, which in turn codes for the same protein: The resulting structure is a virus. One of the simplest, and certainly the best characterised, is the Tobacco mosaic virus, which is pathogenic only for a number of plants. The helically arranged coat proteins and the RNA form a 300 nm long tube with an inner channel of only 4 nm diameter. The structure can be arranged on solid surfaces, [2] and metallized in aqueous suspension, [3] giving access to wires of only 3 nm diameter (Fig 3). [4] Preliminary results on Molecular Dynamics clarify how water is arranged in and on the virus, [5] which is of utmost importance for wet chemical nanofabrication.

References:

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Figures:

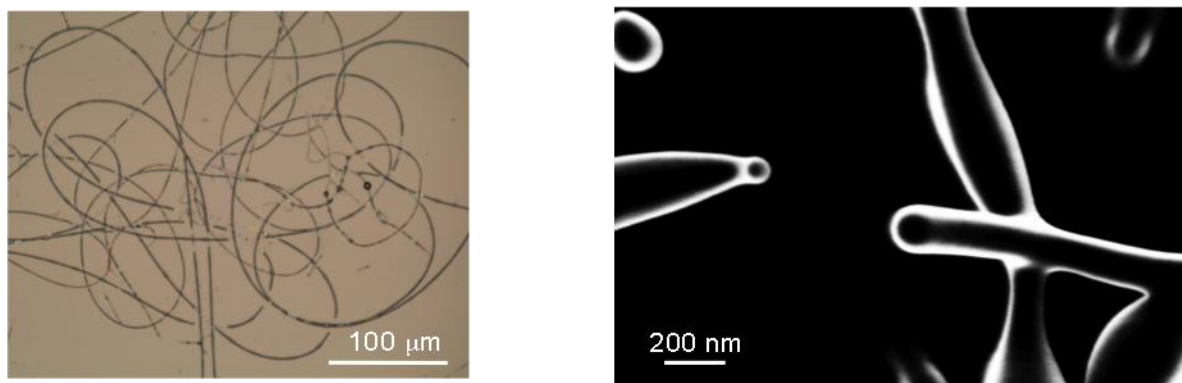


Fig 1: Electrospun di-phenylalanine tubes, optical and electron microscopy.

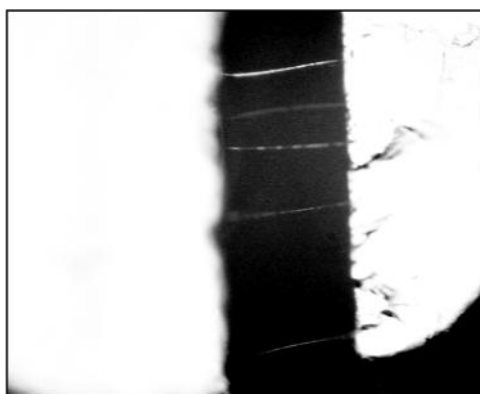


Fig 2: Di-phenylalanine tubes bridging a gap of ca. 0.1 mm.

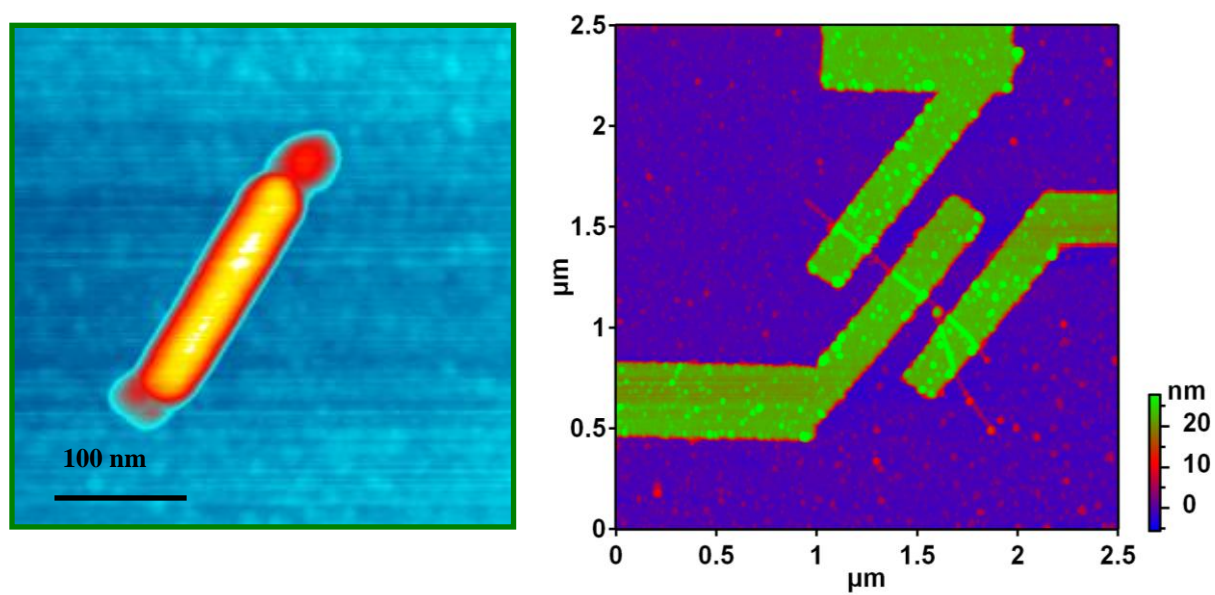


Fig 3: Gold-virus-gold dumbbell structure and contacted 3 nm nickel wire (AFM).