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HYDROGEL NANOFILAMENTS VIA CORE-SHELL ELECTROSPINNING

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Keywords: hydrogel filaments, electrospinning, elastic properties, bending dynamics, drug delivery.

Controlled drug delivery systems are used to improve the conventional administration of drugs. One of the main challenges is to synthesize materials able to find a defined target and to release drugs in a controlled manner [1]. Several research tasks have been focused on developing ideal drug delivery systems made by hydrogel due to their unique properties [2].
The present study is based on the idea that soft and flexible nanomaterials can easily travel in crowed environments of body fluids and biological tissues. Modification of their mechanical properties obtained by changing of the cross-linker amount may give us the possibility to tune the material rigidity according to desired application. Here, we describe a novel method based on coaxial electrospinning for obtaining highly flexible hydrogel nanofilaments able to transport and release dedicated molecules. Two different types of hydrogels (poly(N,N-isopropyl acrylamide) and polyacrylamide) with three polymer/cross-linker ratios were produced and deeply studied.
The nanofilaments morphology was characterized and the release of bovine serum albumin as a function of time was quantified. Mechanical properties of highly deformable hydrogel nanofilaments were evaluated by bending dynamics and Brownian motion observation techniques. The calculated mechanical properties were compared with data obtained by nanoindention.
The results highlight the crucial role of morphology and stiffness on mobility of nanofilaments colloid systems. The information gained are fundamental to design nanoobjects with well-defined chemical and physical behaviour.

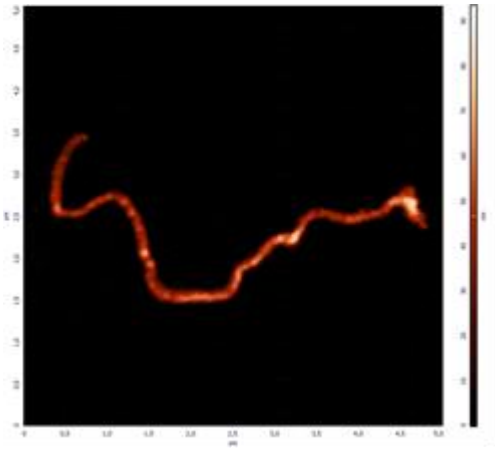

Fig.1. Hydrogel nanofilament AFM topography.

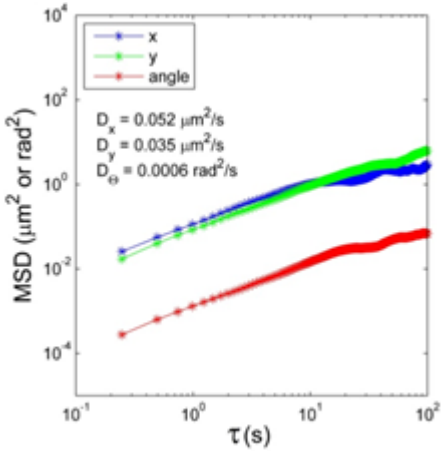

Fig.2. Mean square displacements of a single hydrogel filament suspended in water.

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References

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