

# Surface Structuring of Non-absorbent Polymer Nanocomposites by Laser Interference Patterning

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The post-synthesis modification of polymeric materials through its interaction with high power laser radiation emerges as a powerful strategy for the modification of surface physicochemical properties. Among the various laser techniques, it is noteworthy the structuration by direct laser interference (DLIP) [1], which allows creating periodic nano/microarrays on different polymeric surfaces.

To achieve structuring by DLIP, the polymer must absorb light at  $\lambda$  of the laser, which in the case of non-absorbent/transparent polymers, can be achieved by doping it with a suitable dye that acts as a chromophore and allows laser ablation.[2]

This study presents the structuring by DLIP (355 nm, 10 Hertz) of films of two hybrid materials, composed of a non-absorbent polymer and a chromophore agent. One of such materials consists in silver fluorescent nanoclusters (AgNCIs) stabilized in poly-(methacrylic acid) (PMAA), Ag@PMAA [3], and the other in poly-aniline (PANI) interpenetrated in the crosslinked poly-N-polymer-isopropyl acrylamide PANI@PNIPAM. [4] The surfaces were characterized by UV-Vis and fluorescence spectroscopy and CLM, SEM, and AFM microscopies.

The Figure 1 shows confocal microscopies of the unstructured nanocomposites Ag@PMAA and PANI@PNIPAM films (Figures 1a-1c) and structured ones with two-dimensional periodicity (Figure 1b-1d) using single-pulse DLIP at 355 nm. PMAA and PNIPAM polymers did not show structuring by DLIP when irradiated even with multiple laser pulses.

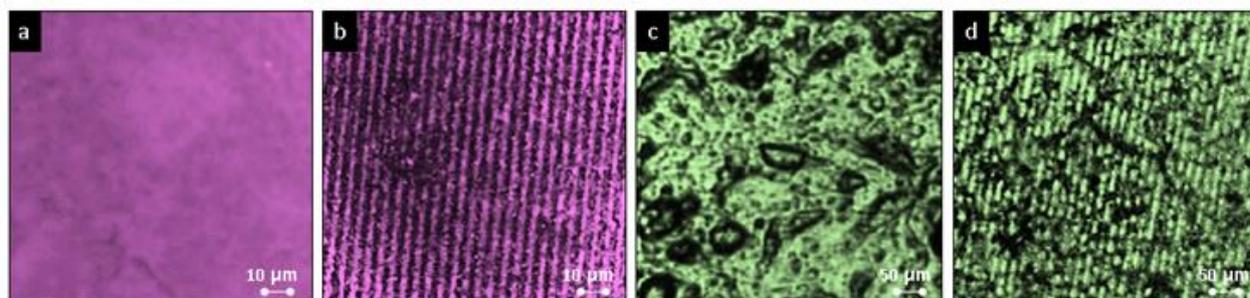


Figure 1: Micrographs of a) Ag@PMAA and b) Ag@PMAA-DLIP 1 pulse c) PANI@PNIPAM and d) PANI@PNIPAM-DLIP 1 pulses.

The incorporation of chromophore agents, AgNCIs and PANI, in transparent polymer matrices PMAA and PNIPAM, respectively, allowed the structuring by laser interference of the resulting nanocomposites. The DLIP process induces morphological modifications only at the superficial level, without altering the physicochemical properties of these nanocomposites. It is

expected in the future, to study the combinatorial effect of surface structuring and AgNCl<sub>s</sub>/PANI presence of these materials in biocompatible film matrices and analyze their impact as antifouling systems for biomedical applications.

References:

- [1] A.F. Lasagni, D.F. Acevedo, C.A. Barbero, F. Mücklich, *Adv. Eng. Mater.* 9 (2007) 99–103.
- [2] M.A. Molina, C.R. Rivarola, M.F. Broglia, D.F. Acevedo, C.A. Barbero, *Soft Matter* 8 (2012) 307–310.
- [3] P. Kunwar, J. Hassinen, G. Bautista, R.H.A. Ras, J. Toivonen, *ACS Nano* 8 (2014) 11165–11171.
- [4] S.B. Abel, M.A. Molina, C.R. Rivarola, M.J. Kogan, C.A. Barbero, *Nanotechnology* 25 (2014) 495602.