Materiali avanzati
Advanced Materials

DII research group
HyMat Laboratory

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Projects:
CARIPLO "Development and characterization of materials for EUV Lithography"
CARITRO "Detection of residual antibiotics in milk based on plasmonic sensors integrated with microfluidic platforms"

Main research topics:
- Design and development of micro and nano-structured electrochemical and optical biosensors
- Materials engineering for 2D and 3D structures micro and nano fabrication
- Microfabrication for cell culture and stem cells applications

Engineered 2D and 3D structures for biological applications

HyMat are engineered hybrid, nanocomposite or polymer materials offering innovative solutions for the development of functional structures from the nano to the mesocale, through the application of the most advanced lithographic techniques.
A highly versatile synthesis platform is built up by a bottom-up approach at low processing temperatures. The key building blocks are functional organic molecules, natural or synthetic polymers and hydrogels, inorganic oxide networks or nanoparticles. Developed HyMat formulations allow to obtain combinations of properties inaccessible with traditional routes.
Synthesized materials enable the fabrication of: optical micro and nano-structures; biocompatible substrates; miniaturized sensors; directly patternable resists for UV, EUV, X-ray, e-beam lithography and nanoimprint technologies; films of variable inorganic and organic compositions, and controlled porosity; 2D and 3D polymers and hydrogel structures are engineered for different biological applications and enable pioneering studies in cell biology.
Examples shown include 2D localized patterned sensing platforms on chip (Fig. 1), 2D substrates for cell differentiation (Fig.2), 3D high resolution structures made of biocompatible polymers (Fig. 3) or natural hydrogels (Fig.5) fabricated with two-photon lithography (Nanoscribe), hydrogel scaffolds printed by 3D stereolithography (Fig.4).

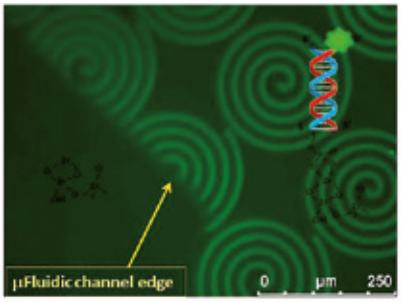
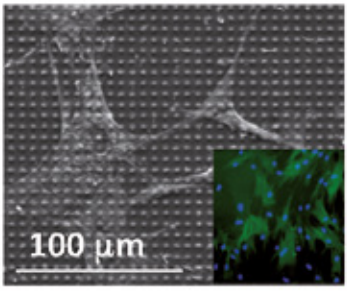


Fig.1. DNA hybridization on ZrO_2 2D UV patterns on chip



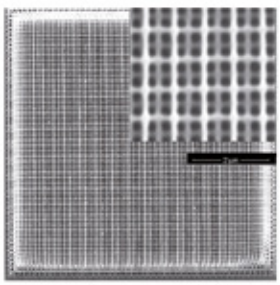


Fig.3. 3D biocompatible polymer woodpile structure

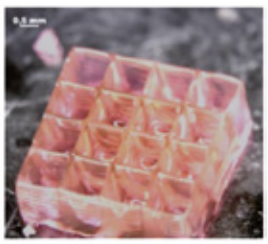


Fig. 4. 3D printed gelatin scaffold