UNIVERSITÀ DI PAVIA

SEMINAR

Università degli Studi di Pavia
Computational Mechanics & Advanced Materials Group - DICAr

3D@UniPV

Innovative biomaterials for blood-contacting medical devices: from synthetic polyurethanes to biomimetic silk

Sofia's presentation will provide a holistic view of recently developed materials for cardiovascular applications, from synthetic biomaterials for aortic valve replacement to biomimetic silk materials for tissue-engineered vascular grafts (TEVGs). Non-isocyanate polyurethanes (NIPUs), developed as alternatives to conventional polyurethanes synthesized from toxic isocyanates, were used to produce versatile polymer networks for medical devices. Thermal- or UV-crosslinked NIPUs were combined with fluid-structure interaction modelling to optimize valve design and minimize leaflet shear stress. The resulting valves showed ISO-compliant hydrodynamic performance comparable to clinically used bioprostheses.

More recently, robust thin films were developed from the recombinant spider silk protein A3IA. These films combine vascular graft-relevant mechanical properties with favourable blood and vascular cell interactions, while remaining stable after sterilization. Their mechanical robustness, progressive biodegradability, hemocompatibility, and support of vascular cell attachment make A3IA films promising biomaterials for off-the shelf TEVGs.

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