Post-functionalization of Hydrogel Surfaces with Peptides and Complex Chemistries via Polydiacetylene Arrays

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The functionalization of surfaces in polymeric materials used as cell culture scaffolds presents a significant challenge, due to material heterogeneity that limits detailed control over ligand display. Control over surface functionality at the nanoscale level is a critical aspect in numerous industries, such as nanoscale electronics and regenerative medicine. However, soft interfaces, which are often amorphous and porous, pose difficulties in achieving this control. Polymeric materials used as cell culture scaffolds exemplify this issue, as their pores have diameters in the hundreds of nanometer range, causing much of the surface to be recessed and hindering the functionalization of surfaces to interact with larger objects such as cells. This limits the number of sites available for maximum accessibility and interaction with objects larger than the pores.

Researchers at Purdue have developed a technology that solves this problem through further functionalizing the surface of a polymeric material. The technology aims to offer a comprehensive and flexible method to create nanoscale patterns of functional components (such as chemically or biologically reactive or interactive substances) on the surfaces of polymeric materials such as hydrogels through a modular two-step process that first installs a highly structured nanometer thick film with chemical functionalities that can be post-functionalization using click reactions.

Technology Validation: Atomic Force Microscopy (AFM) and Scanning Electron Microscopy (SEM) were used to verify topochemical polymerization.

Advantages:
-Better control of structure at soft interfaces
-Better access for functionalizing surfaces to interact with larger objects like cells

Applications:
-Regenerative medicine
-Nanoscale electronics
-Wearable electronics

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