Biomaterial Surfaces & Interfaces
Room Naupaka Salon 1-3 - Session BI-MoP

Biomaterial Surfaces & Interfaces Poster Session

BI-MoP-1 Fabrication of Hydrogel-Based Optical Biosensor for Smart Intraocular Lens, ***Soongeun Kwon***, *Y. Eom, H. Choi, J. Ahn, S. Park, H. Lim, G. Kim, K. Choi, J. Lee,* Korea Institute of Machinery and Materials, Republic of Korea

Due to the high biocompatibility, facile chemical modification and excellent responsiveness, hydrogel materials have received great deal of attention as wearable or implantable biosensor substrates. To fabricate a hydrogel-based biosensor, a stable bond at the interface of hydrogel and a functional sensing material is essential. In this study, we demonstrated fabrication and application of hydrogel-based optical sensor with a biocompatible micro-grating pattern for implantable medical devices.

To fabricate a functional micro-grating pattern, photolithographic patterning of a photoresist (PR) was performed to define the micro-scale line and spacing pattern. Gold (Au) nanoparticles spin-coated on the PR pattern were patterned by ligand exchange and lift-off process, resulting in an Au micro-grating pattern on a silicon (Si) wafer. The as-fabricated Au micro-grating pattern showed a rabbit ear morphology by controlling the thickness of the PR pattern. Subsequently, molding of a hydrogel precursor into the Au micro-grating pattern on a Si wafer was conducted to transfer the Au micro-grating pattern to the target hydrogel substrate.

The rabbit ear morphology and porous structure of the Au pattern enabled large interfacial contact area between hydrogel precursor and Au nanoparticles, resulting in stable bonding at the interface of Au micro-grating pattern and hydrogel substrate. Due to the biocompatibility of Au and hydrogel, this hydrogel-based biosensor can be used as for implantable medical devices.

As a case study, we demonstrated the application of hydrogel-based optical sensor composed of Au micro-grating pattern for smart intraocular lens (IOL). A pH-responsive hydrogel sensor with Au grating pattern was attached to an IOL to measure the micro-displacement of reactive hydrogel in response to pH changes by optical Moiré pattern detection. With the optical Moiré pattern detection scheme, the proposed hydrogel-based biosensor provides novel implantable optical sensor without external battery, highlightening its potential as a versatile tool for detecting various disease-specific biomarkers.

BI-MoP-2 Correlative Microscopy Without the Instrument Manufacturer; Using Computer-Readable Fiducial Markers to Navigate Specimens Irrespective of Who Made the Sample Stage, ***Peter Cumpson,*** La Trobe University, Australia

In the diverse field of microscopy, researchers often face challenges in correlating data across different instruments, each with proprietary hardware and software. This work introduces a novel, manufacturer-agnostic solution for correlative microscopy using computer-readable fiducial markers, facilitating seamless navigation and analysis across various microscopy platforms.

Our approach employs laser-etched fiducial markers on sample holders, enabling precise localisation of sample features. This methodology eliminates the need for instrument-specific solutions, significantly enhancing workflow efficiency and accuracy.

We have demonstrated the effectiveness of our system across multiple microscopy techniques, including Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), Energy Dispersive X-ray Spectroscopy (EDX), X-ray Photoelectron Spectroscopy (XPS), and Time-of-Flight Secondary Ion Mass Spectrometry (ToF-SIMS). Our results indicate that this "GPS map for microscopy" not only improves the precision of correlative microscopy but also significantly reduces the time and costs associated with manual sample alignment and calibration.

In collaboration with the National Physical Laboratory (NPL) and University of Durham in the UK we have begun a project to demonstrate and verify the accuracy of this technique. This model considers various scales and imaging modalities, ensuring traceable measurement accuracy and enhancing the reliability of our method.

Our system offers significant advantages for a wide range of applications, from material science and battery research to biomedical and pharmaceutical studies. By enabling precise and consistent navigation across different microscopes, we facilitate interdisciplinary collaboration and accelerate scientific discoveries.

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