**An All-Laser-Written Sensor-Integrated Porous Microneedle Array for Non-Invasive Monitoring of Biomolecules**

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Microneedle arrays (MNAs) emerge as a pivotal innovation in biomedical engineering due to their minimally invasive access to biological fluids.(1) Instead of sampling blood, which is traditionally an invasive approach for health monitoring, MN-based wearable sensors analyze the interstitial fluid (ISF) through skin. Here, we present a facile, low-cost, and cleanroom-free technique for fabricating MNAs using molds created by laser ablation. A variety of MNA shapes with different heights and tip diameters are easily fabricated by changing the speed and power of the laser system. Using the optimized molds, porous polydimethylsiloxane MNAs is fabricated via the salt leaching approach.(2)The optimized microneedles have a height of ~980 μm and a tip diameter of ~20 μm, and are suitable to penetrate the dermis layer of skin to access ISF painlessly. As proof of concept, we developed an integrated sensor-MNA chip for detection of uric acid (UA) and tyrosine (Tyr) simultaneously. The biodevice is constructed using a low-cost process where the MNA is attached to a printed electrochemical sensor via a lithography-free microfluidic channel. Our preliminary data shows that the developed sensor-MNA system can successfully extract and detect UA and Tyr from an agar-based skin model. To extract fluids from ISF more efficiently, further optimization of the MNA structure, e.g. based on hydrogels with methacrylated hyaluronic acid and porous polylactic acid, is under investigation. In addition to MNA optimization, future work includes integration of the electrochemical sensors with physical sensors (such as temperature and pH) and developing sensor array for multiplexed biochemical sensing.

**References:**

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