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3D-Printed Microparticles for Enhanced Cell Capture and Disease Diagnostics

Stanford researchers have developed a high-resolution, roll-to-roll continuous liquid interface production (r2rCLIP) technology to fabricate advanced microparticles, enabling superior bio-conjugation, barcode detection, and improved stability for more accurate and efficient cellular analytics and disease diagnostics.

Current microparticle fabrication methods used in flow cytometry and cellular capture analytics are limited by their microfluidic flow polymerization approach. These methods often result in microparticles that are temperature sensitive, prone to aggregation, and can deform during centrifugation, significantly reducing their effectiveness in disease diagnostics, cellular analysis, and other bioanalytical applications.

Stanford Researchers have developed a novel microparticle platform utilizing high-resolution Roll-to-Roll Continuous Liquid Interface Production (r2rCLIP). This cutting-edge freeform fabrication technique provides geometric flexibility and material integration versatility, overcoming the limitations of conventional fabrication methods. The resulting microparticles offer enhanced surface area-to-volume efficiency, optimized for bioconjugation and cellular diagnostics, thus making them ideal for disease detection and diagnosis.

Stage of Development:

Proof of Concept

Applications

- Advanced microparticles for cellular analytics

- Flow cytometry
- Disease diagnostics
- Human sample analytics

Advantages

- Enhanced bio-conjugation efficiency
- Overcomes geometric limitations of existing microparticle fabrication techniques
- Scalable and customizable fabrication
- Enhanced particle stability and surface area, leading to more accurate and robust diagnostics
- Exosome and cytokine characterization

Publications

- Kronenfeld, J.M., Rother, L., Saccone, M.A. et al. Roll-to-roll, high-resolution 3D printing of shape-specific particles. *Nature* 627, 306–312 (2024).

Patents

- Published Application: WO2025240897

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