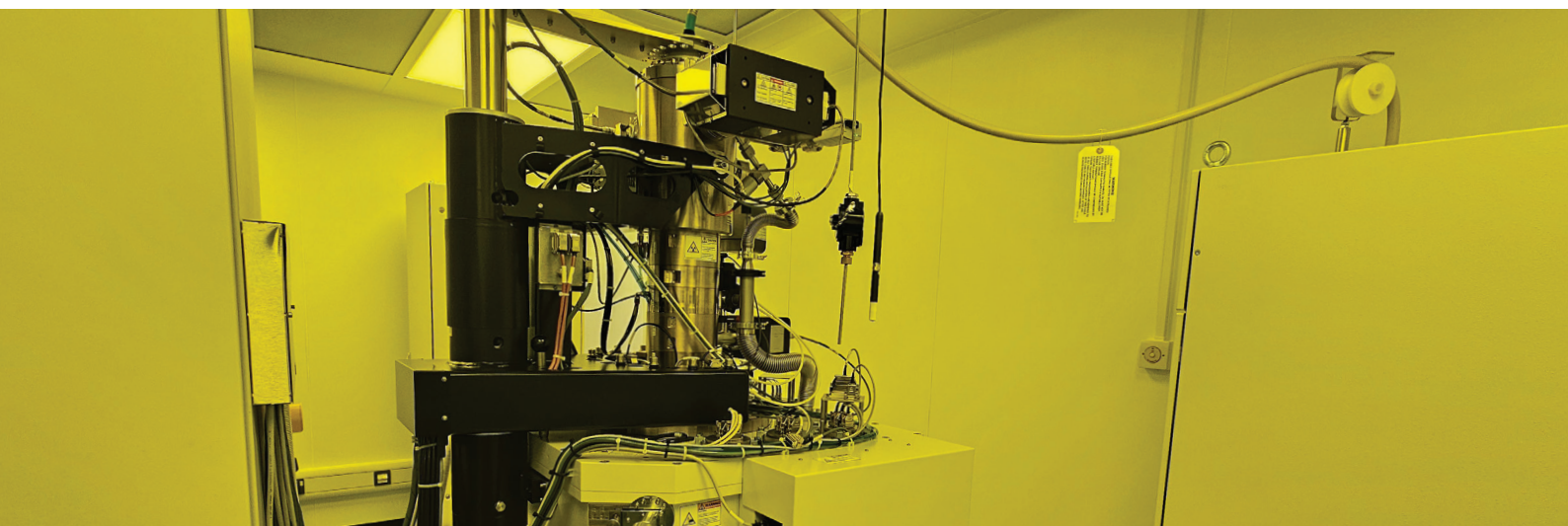




Revolutionising Dynamic Optical Control

In the rapidly evolving field of optical engineering, the integration of metasurfaces with dynamic control elements remains a pivotal challenge. Access to the Royce Electron Beam Lithography System enabled researchers from the University of Cambridge to fabricate a liquid-crystal Huygens metasurface, leading to an unprecedented level of phase modulation in these structures. The technology promises significant advances in the biomedical sector.



Royce Electron-Beam Lithography System

This system is a Raith EBPG 5200 capable of device fabrication at the nanometre scale. This state-of-the-art system combines best-in-class lithography performance with high-throughput and full automation.

The equipment's electron-optics performance allows fabrication of features as small as 5nm. It's equipped with a thermal field emission gun operating at 100 kV, reducing proximity-effect related difficulties and enabling high aspect-ratio patterning.

Accurate feature sizing and placement is derived from the tool's precision interferometer stage. The overlay of subsequent pattern layers can be better than 10nm.

RESULTS

Utilizing the Raith EBPG 5200 Electron-Beam Lithography System, Wenhan successfully fabricated a high-density pattern metasurface array. This innovative approach allowed him to manipulate the metasurface's resonance properties electrically, harnessing the anisotropic properties of liquid crystals. As a result, he achieved continuous phase-only tuning in transmission over a full 2π range; a First in the field.

The precise control of light transmission achieved opens new frontiers in non-invasive medical imaging, enhancing diagnostic accuracy and patient care. This was published in the journal; Optics Express. This research has the potential to revolutionise medical technology. In the burgeoning field of mixed reality, the technology promises innovative interaction modalities, blending digital and physical worlds seamlessly.

ROYCE SUPPORT

Royce support was instrumental in the team's success, providing access to state-of-the-art equipment, funding, and invaluable expertise. Jonathan Griffiths, the Electron-Beam Lithography Facility Manager, and his team played a crucial role in the project. They expertly handled the entire lithography process, from spin coating of resist materials to the precise EBL patterning and subsequent development. They provided valuable insights when reviewing the CAD files before patterning, selecting an appropriate process and advising on subsequent manufacturing techniques.

“Jonathan Griffiths and his team played a crucial role in our project. They expertly handled the entire Electron-Beam Lithography process, and provided valuable insights.”

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“The Electronic Beam Lithography system's 200 mm platform allowed for processing multiple samples simultaneously, and its advanced pattern-generating features enabled high fidelity pattern production. Additionally, the system's high precision and capability to achieve less than 8 nm feature size enabled us to fabricate the complex patterns essential for our liquid crystal tunable Huygens metasurface. This level of detail was crucial for the success of our project and would not have been possible without the EBL system.”

Wenhan Zhang
PhD Student, University of Cambridge

