

**TECH OFFER**

## Nanoscale 3D Printed Optical Elements for Security Applications



### KEY INFORMATION

**TECHNOLOGY CATEGORY:**

**Electronics** - Lasers, Optics & Photonics  
**Manufacturing** - Additive Manufacturing  
**Manufacturing** - Moulding, Sintering, Casting & Nanoimprinting  
**Materials** - Nano Materials

**TECHNOLOGY READINESS LEVEL (TRL):** **TRL3**

**COUNTRY:** **SINGAPORE**

**ID NUMBER:** **TO174901**

### OVERVIEW

Nanoscale 3D printed optical elements are the next-generation security features in physical products to combat the globally evolving problem of counterfeiting. Due to the design of complex structures with ultra-high resolution, nanoscale 3D printed optical elements are extremely difficult to copy by other means, while producing special optical effects for authentication.

### TECHNOLOGY FEATURES & SPECIFICATIONS

This technology involves the design and fabrication of nanoscale 3D structures by two-photon polymerization lithography. These structures have ultra-high resolution of up to 100,000 dots per inch (dpi) and are used to control the various properties

(amplitude, phase, colour, orbital angular momentum) of visible light to achieve special optical effects. For example, a wide range of colours are directly produced by varying the geometry of the nanostructures, and do not require any additional processing steps. The optical effects serve as security features that can be verified by naked eye, lasers, and optical microscope setups.

## POTENTIAL APPLICATIONS

This technology can be used as product authentication labels in high-value goods such as medicine, jewellery, and watches to prevent counterfeiting.

## UNIQUE VALUE PROPOSITION

Nanoscale 3D printing enables the fabrication of complex optical elements with ultra-high resolution. The key advantages of the technology are given below -

- Resolution of up to 100,000 dpi compared to conventional technologies which work at ~ 1000 dpi.
- Optically stable elements.
- Environment friendly and non toxic.

The fabricated nanostructures are made of polymers and compared to technologies in this domain like quantum dots, are potentially more stable and with a lower risk of toxicity. This technology promises new and improved capabilities for security applications.