Photonics on a Fiber

aBeam Technologies, Inc.

http://fiberphotonics.com/

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aBeam Technologies develops novel photonics-on-a-fiber devices for a precise and reproducible wavefront manipulation. Devices are made by fiber imprinting, a novel technology suitable for low-cost and high-throughput manufacturing of free-form 3D diffractive optical elements (DOE) directly on a fiber. Unlike other conventional fiber optics, complex 3D photonic structures are fabricated at the end of the fiber to apply optical function, which makes it possible to manipulate the light output with a customizable focal distance of any shape, without relying on free-space optics. Using the fiber imprint technology, material properties of DOEs, for example refractive index, can be customized to enable novel immersion applications. The revolutionary fiber imprint technology is inexpensive and scalable for volume production and can lead to advances in a variety of integrated optics applications, such as laser machining, lab-on-a-fiber, and biomedical sensors.

Several examples of our fiber photonic devices are presented (Figure 1). First example is a 3D diffractive beam-splitter that produces the highest 3D lithographic resolution on a fiber. Second, a vortex phase plate on a fiber is shown. An optical vortex – also known as twisted light – is a special type of beam that carries orbital angular momentum with a dark spot of zero light intensity on axis. Vortex fiber is a low-cost alternative to the free space vortex phase plate with no need for optical alignment. Thirdly, a novel high-refractive index lens is presented. The Fresnel lens on a fiber is fabricated out of material with a higher index of refraction than the fiber itself. Due to the refractive index contrast, the lens focuses the light down to a diffraction limited spot even inside the liquid, which is impossible using conventional fiber lens. Finally, a functional 3D plasmonic optical transformer based near-field optical probe is presented (Figure 2). “Campanile” near-field probe is a novel type of optical probes for performing spectroscopy at nanometer scale resolution. While the conventional fabrication method is based on focused ion beam milling, not suitable for volume production, fiber nanoimprint technology has dramatically simplified the process, reduced the cost, and improved the throughput for future commercialization.

Fiber imprinting is not only an inexpensive fabrication alternative to the conventional fiber optics but also facilitates the simplified and easy integration of complex optical components to a fiber. In addition, unprecedented optical functionalities for immersion applications are realized where other types of fiber lenses do not work. With this new capability, there are many applications in integrated optic, display, sensors, and telecommunications where the imprinted

3D components manipulate light in various ways and do so reproducibly at a high throughput and low cost.

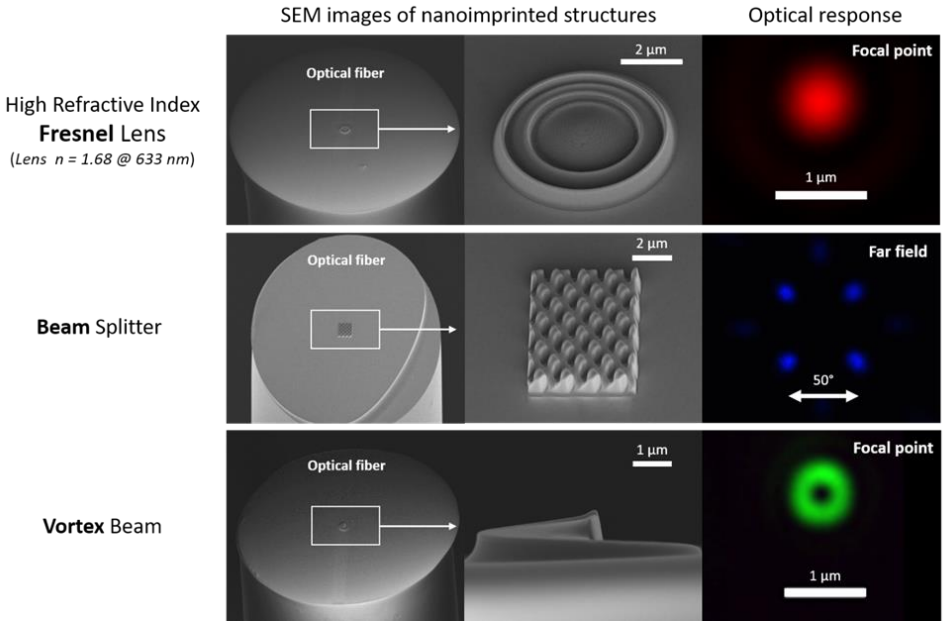

Figure 1: A collage of diffractive optical elements on a fiber and their optical performance.

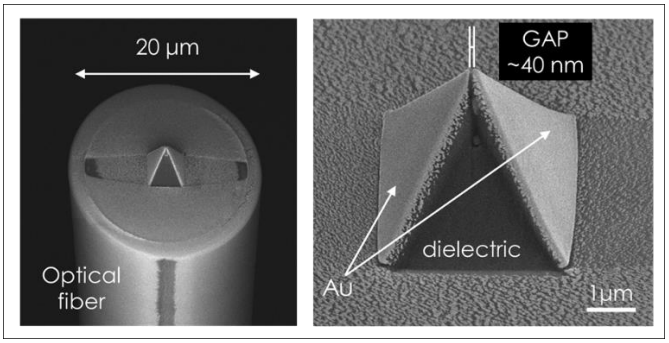

Figure 2: Plasmonic optical transformer based near-field scanning probes by fiber imprinting.

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