

Meta-fibers: merging nanophotonics and fibers

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Remote collection and analysis of light is highly important for a plethora of applications including spectroscopy, endoscopy, biosensing, quantum communications, etc. Commercial optical fibers are the best platform for this purpose due to their ability to operate in strongly limited and closed spaces (particularly, in-vivo). The payback of this advantage is the low coupling of the incident light into the fiber, especially under oblique incidence.

Here, we propose to overcome this fundamental limitation by enhancing the fiber tips with axial all-dielectric nanostructures. Indeed, we demonstrate the improvement of the light coupling efficiency by several orders of magnitude for the single-mode, multimode and multicore fibers reinforced with polymer concentric nanorings fabricated by direct laser writing approach. We have demonstrated light collection improvement at multiple selected angles and over large angular intervals. The applications can be found in a variety of cutting-edge fields that require highly efficient remote light collection.

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