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An adiabatic silica taper based on two sequential tapering routines (Article)

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Abstract

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Microfiber-based devices have a great potential in many applications due to their extraordinary optical and mechanical properties. An adiabatic silica-based taper is required for most of the applications and thus, adiabaticity criterion has to be estimated and satisfied to avoid high optical loss emerging when taper 's profile is not controlled properly. This requires obtaining propagation constants via solving boundary condition problem at each position along the taper. Yet, this procedure involves intensive computational and time-consuming solving of complex Maxwell vector equations. This paper proposed an efficient method to model the taper profile, evaluate the adiabaticity and simulate it using Finite Element Analysis software. The model facilitates design phase and optimize fabrication process for any fiber-based device. A slow gradual radius reduction rates can guarantee adiabatic profiles with the expense of longer transition sections. In miniature devices, such as sensors and micro-resonators, transition regions are preferable to be as short as possible while the narrow waist is preferred to be long and uniform. To balance between short transition preference and low loss condition, we proposed a design based on two tapering sequential routines. The simulation results confirmed our design adiabaticity. From the optical spectrum of the fabricated taper, it is found that the loss is less than 1dBm and the spectrum is not distorted.

Author keywords

Adiabaticity COMSOL FEA Microfiber Taper Tapered fiber

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