

profile is chosen such that the probe is positioned in contact with the surface (see Fig. 5). Finite difference mode solvers and 3D-FDTD code was developed by Christina Manolatu. Analysis and figures were generated using Matlab.

The optical source used for the experiments is a multi-line external cavity laser (ECL) amplified with a 120 mW EDFA (JDS Uniphase) and filtered using a 1.4 nm FWHM tunable bandpass filter (TBF) centered at 1532 nm. The linewidth of the external cavity laser was less than the resolution of our optical spectrum analyzer (<10 pm). The output of the TBF was sent through a digital polarization controller (HP) which we used to polarize the input to excite a combination of TE and TM modes. For the short-coherence-length measurements the ECL was turned off leaving 1.4 nm bandwidth amplified spontaneous emission as our source. Light was coupled into and out of the waveguide using fibers glued to the waveguide facets using a UV curable epoxy (see [21] for details of the packaging). In all cases, a single optical source is used to illuminate the waveguide from only the input side. The waveguide was imaged with a Dimension 3100 atomic force microscope using a Pt/Ir coated AFM probe from Nanosensors. The waveguide output was collected into a fiber glued to the waveguide facet and measured with a Newport 1818-IG photodetector and 2832c power meter. The analog output of the power meter was amplified using an HP voltage pre-amplifier with a 30 Hz low pass filter and then sent to the analog input of the AFM for simultaneous recording with the waveguide topography.

7. Conclusion

The distinct near-field profiles for counter-propagating waves reveal fundamental differences between optical propagation in nanoscale waveguides compared to free-space and fiber optics. This phenomenon is solely a consequence of strong optical confinement and is likely to occur in the nanoscale high-index waveguides that are used widely in industrial and academic research labs. In addition to potentially affecting device performance, this phenomenon could be utilized as a basis for selectively attenuating reflected waves. Active components or specific waveguide geometries could be developed to create uni-directional integrated devices which could limit the intensity of reflected light. This would provide a path toward developing robust nanophotonic devices and architectures unhindered by optical reflections.

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