

a systematic change from the near-field pattern to Fraunhofer diffraction. For systematic analyses, forty-six guided modes were found by the FDFD method with PML boundary condition. It was found that the scalar summation of the ten higher-order modes' intensities by propagation of the ASPW resulted in evolution of the diffraction patterns with a good agreement with experimental measurements. The triangular core with the central hole in an optical fiber was found to give high potential in all-fiber beam shaping, which can be readily applied in novel nano- and micro-pattern generation.

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