

# **Diameter Measurement of sub-micrometer optical fiber based on interference signal of Mie scattered light**

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Nano/micro-optical fibers find applications in various fields owing to their significant properties. Micro-nanofibers, which generate near-field light outside the fiber, are employed for biosensing and optical tweezers, leveraging their near-field characteristics. Furthermore, they serve as waveguides and are integrated into evanescent couplers in the whispering gallery mode. Additionally, they hold considerable promise as wavelength- or sub-wavelength-scale waveguides, facilitating continuous light oscillation and nanocavities in the field of photonics. Their capacity to easily manifest nonlinear phenomena makes them particularly attractive. In recent times, this device has garnered significant attention among researchers for its ability to generate entangled photon pairs. This paper introduces a novel method for measuring the diameter of sub-micrometer fibers with diameters less than 1  $\mu\text{m}$ . The technique employs counter-propagating beams for illumination, creating a standing wave around the fiber. Through active control of the spatial phase of this standing wave, the scattered light intensity distribution from the fiber is modulated. The modulation pattern is influenced by the fiber diameter. Analyzing the modulated scattered light intensity distribution enables the measurement of the sub-micrometer fiber diameter. Experimental validation confirmed the viability of measuring the diameter of a fiber approximately 500 nm in size using the proposed method.

Short biography:



Masaki Michihata received the master's degree and PhD in Mechanical Engineering from Osaka University, Japan, 2007, 2010, respectively. He worked as the research associate of the Department of Mechanical Engineering, Osaka University for 2010 to 2014, and of research center for advanced science and technology (RCAST), the University of Tokyo for 2015 to 2018. He is now an associate professor of Department of Precision Engineering, the University of Tokyo since 2019. His research interest includes three-dimensional measurement, optical metrology, absolute length measurement. He is a member of Japan Society for Precision Engineering (JSPE), Japan Society of Mechanical Engineers (JSME)