(Article: 36)

FABRICATION OF COMPUTER ASSIST PENCIL SHAPED OPTICAL FIBER TIPS FOR POTENTIAL APPLICATION IN BIOMEDICAL SMALL OBJECT IMAGING

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ABSTRACT

In recent years research and development of Optical fiber as a imaging tools are gaining momentum because of the growing interest in the field of small object specially nano object imaging with high-accuracy and high-resolution within the limit of visible light as well as UV-Visible and Infra regime. Major enhancement of near-field scanning optical microscope (NSOM) technique makes optical fibrenano probe an inevitable tools and has been applied to many fields extensively.Optical fiber technology offers a convenient, affordable, safe and effective approach for the delivery and collection of light to and from the tissue region of interest, and has been employed clinically since the 1960s.

The high throughput of optical fiber probe make them useful for a variety of applications including skin cancer imaging ,small object imaging and specially nano object imaging etc. Moreover, the potential applications of optical fiber tip in all the fields of basic natural sciences as well as in Biomedical Imaging, Spectroscopy, Microscopy and Real time in-situ imaging are obviously immense. Thus, this wide range application of optical fiber tip and optical resolution regime is gradually increasing the importance of suitable optical probe that can be operated at those domains.

ABSTRACT

Most popular method to produce optical fibrenano probe is chemical etching with Buffer Hydro Fluric Acid (BHF) which is most well-known but the etching rate of this method is comparably slow and time consuming. A method is developed to produce chemically etched optical fiber tips for small and nano object imaging with valuable properties such as large transmission and no lateral light leaks by simple homemade selective etching technique which offers faster etching rate and very simple laboratory set up. Probing optical properties of materials and optical characterization of molecular defects at the nanometer scale have been inaccessible until recently due to the diffraction limit of light. With the invention of nanometric fiber optic tip by the help of different etching and tapering technique, resolution at the 50±100 nm level using visible or near infrared light is now practical. The unique capability of fiber optic probe to simultaneously measure surface topography and local optoelectronic properties, thereby eliminating the need to perform cross correlation analysis on results obtained using different techniques, is particularly useful in this area. The technical enhancement of chemical etching through our home made selective etching technique was observed here.

Keywords: Computer probe,Probe,NSOMprobe,Pencilprobe,Fiber pencil

INTRODUCTION

Computer assist optical fiber probe relies on the activity measurement in order to provide solutions for communication and environmental control without movement[1]. Although it was initially intended for remote and long range communication with great abilities ,it can also be used as an alternative communication channel by the healthcare ones[1,2]. Over the past two decades, several studies were performed towards the development ofthese systems, which require optical fiber. Although still in its infancy; it is no longer a realm of science fiction, but an evolving area of research and applications.

INTRODUCTION

It propose to augment system capabilities by enabling device to interact with a computer through a conscious and spontaneous modulation of their signal-waves after a short time period[3]. Nowadays, the typical computer assist optical fiber probe systems measure specific features ofsignal activity and translate them into device control signals, generally making use of optical fiber probe techniques. Essentially hardware/software composes the standard fiber based device.The most essential part- signal acquisition and execution are generally constituted through optical fiber probe[1].Many factors affecting the performance of this system ,the most is diffraction limit of light[3].

To overcome this limit a new technique Near field Scanning Optical Microscopy (NSOM) is introduced and the most important part of this method is contact tip diameter of the fiber probe. The probe tip is a key element that determines the quality of measurements[4,5,6].The size and the shape of a nanoprobe have to be optimized according to the application. Since fiber probes of good quality are still expensive and restricted to a few standard types, versatile tip fabrication remains of great interest to scientists working in the areaof fiberoptics[7] . Two main techniques have been used for the fabrication of tapered fibers: pulling under laser heating and chemical etching[3,4,8]. The pulling technique has been quite well characterized and generally offers tips with small cone angles which yield low optical throughput. Fiber probes produced by chemical etching usually provide higher optical throughput due to larger cone angles and conservation of the fiber core up to the tip apex[9]. However, its cost is rather high and the probability to create optical fibrenanoprobe in great quantity has not been realized, which is a disadvantage to commercial applications of the nanoprobe.The recent technique of tip fabrication with buffer Hydro Fluric(BHF) acid is well acceptable but time consuming so we have further evaluated the technique with selective chemical etching[4].