

论文

制备扫描近场光学显微镜光纤探针的自动化腐蚀方法

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摘要:

提出了一种制备扫描近场光学显微镜光纤探针的自动化腐蚀方案.该方案利用静态腐蚀过程中光纤所形成的特殊结构,及动态腐蚀过程中光纤在氢氟酸中的移动所带来的新月形弯液面在光纤表面接触位置的变化,通过合理控制腐蚀时间来制备尖端锐利、大锥角或多锥体角等各种结构的探针.设计方案采用计算机控制整个装置实现了探针制备过程的自动化,保持了腐蚀光纤探针实验条件的一致性.实验结果表明,采用此方案可以制备出尖端孔径小于100 nm且锥体角高达70°的光纤探针,且重复性高.此外,该方案的装置结构简单,实现容易.

关键词: 扫描探针技术 扫描近场光学显微镜 光纤探针 化学腐蚀法

Design of Automatism Etching for Fabricating Fiber Probes of Scanning Near-field Optical Microscope

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Abstract:

A design of automatism etching for fabricating the fiber probe of scanning near-field optical microscope is proposed.Probes of various structures,such as sharp tip and large cone angle or multi-taper,can be formed by using the special structure formed in the static etching process and the change of the contact position of meniscus on the fiber surface caused by the fiber's movement in the dynamic etching process,and controlling the time of etching.The automatism of fabricating the probe is realized by controlling the whole equipment with the computer in this design,so that the experimental conditions of forming fiber probe are the same.The experimental results show that fiber probes with 70° cone angle can be fabricated,which is under 100nm.And,the fiber probes with high repeatability and different configuration can be obtained by using this design,so that different requirements can be satisfied.In addition,the configuration of the design is very simple and can be actualized easily.

Keywords: Scanning probe technology Scanning near-field optical microscopy Fiber probe Chemical etching

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参考文献:

[1] HESS H F,BETZIG E,HARRIS T D,et al.Near-field spectroscopy of the quantum constituents of a luminescent system [J].Science,1994,264(17): 1740-1745.

[2] KOOPMAN M,CAMBI A,BAKKER B111de,et al.Near-field scanning optical microscopy in liquid for high resolution single molecule detection on dendritic cells [J].FEBS Letters,2004,573: 6-10.

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- [3] SIPE J E,BOYD R W.Nanocomposite materials for nonlinear optics based on local field effects [J] .Top App Phys,2002,82: 1-19.
- [4] SMOLYANINOV I,MAZZONI D,DAVIS C.Near-field direct-write ultraviolet lithography and shear force microscopic studies of the lithographic process [J] .Appl Phys Lett,1995,67(26): 3859-3861.
- [5] GHISLAIN L,ELINGS V,CRONIER K,et al.Near-field photolithography with a solid immersion lens [J] .Appl Phys Lett,1999,74(4): 501-503.
- [6] FAN Xiao-ming,WANG Ke-yi.Constant amplitude feedback control in near-field scanning optical microscopy in shear force mode [J] .Acta Photonica Sinica,2008,37(8): 1585-1588.
- 范晓明,王克逸.剪切力模式近场扫描光学显微镜的恒幅反馈控制方法研究 [J] .光子学报,2008,37(8): 1585-1588.
- [7] NOVOTNY L,POHL D W,HECHT B.Scanning near-field optical probe with ultrasmall spot size [J] .Opt Lett,1995,20(9): 970-972.
- [8] SAIKI T,MONONOBE S,OHTSU M.Tailoring a high-transmission fiber probe for photon scanning tunneling microscope [J] .Appl Phys Lett,1996,68(19): 2612-2614.
- [9] TATSUI T,KOUROGI M,OHTSU M.Increasing throughput of a near-field optical fiber probe over 1000 times by the use of a triple-tapered structure.Appl Phys Lett,1998,73(15): 2090-2092.
- [10] MURAMASTU H,HOMMA K,CHIBA N,et al.Dynamic etching method for fabrication a variety of tip shapes in the optical fiber probe of a scanning near-field optical microscope [J] .J Microsc,1999,194(2): 383-387.
- [11] DAVIS R C,WILLIAMS C C,NEUZIL P.Optical intensity mapping on the nanometer scale by near-field photodetection optical microscopy [J] .Opt Lett,1996,21: 447-449.
- [12] ZHANG Gong-li,BAI Yong-lin,WHITE J D,et al.Fabrication of a high-transmission fiber probe for near-field scanning optical microscope [J] .Acta Photonica Sinica,1999,28(5): 436-439.
- 张工力,白永林,J D White,等.一种高透过率光纤探针的制作 [J] .光子学报,1999,28(5): 436-439.
- [13] HELD T,EMONIN S,MARTI O,et al.Method to produce high-resolution scanning near-field optical microscope probes by beveling optical fibers [J] .Rev Sci Instrum,2000,71(8): 3118-3122.
- [14] CHUNG Yung-hui,SUN Kuo-gung,WANG Chia-jen,et al.A simple chemical etching technique for reproducible fabrication of robust scanning near-field fiber probes [J] .Rev Sci Instrum,1998,69(2): 437-439.
- [15] LI Chang-an,LIU Zhan-hui,SUN Yong-kang,et al.Fabrication of optical fiber probes by dynamic chemical etching based on siphon principle [J] .Acta Optica sinica,2004,24(11): 1441-1444.
- 李昌安,刘战辉,孙永康,等.虹吸动态化学腐蚀法制备近场光学显微镜光纤探针的研究 [J] .光学学报,2004,24(11): 1441-1444.

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2. 吴才章;叶梅;叶虎年.扫描近场光学显微镜的光耦合偶极子模型[J]. 光子学报, 2005,34(10 ): 1546-1549
3. 王学恩;范兆忠;张禄;唐天同.金属覆层光纤探针近场特性研究[J]. 光子学报, 2004,33(8 ): 912-915

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