

激光雷达专辑

全光纤转动拉曼激光雷达的光纤光栅分光技术研究?

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摘要:

设计了一款由可见光波段的光纤布喇格光栅和光纤耦合器构建的全光纤转动拉曼激光雷达分光系统。利用相位掩模板侧向成功刻写530 nm波段光纤布喇格光栅, 并初步测试其透射谱和反射谱性能。为提高光纤光栅中心波长与大气氮气分子转动拉曼谱线的匹配特性, 利用悬臂梁设计高调谱灵敏度的调谐系统。实验结果表明, 成功研制的可见光波段光纤布喇格光栅其反射率约为95%, 带宽约为0.3 nm, 应力调谐系统可实现 ± 0.6 nm范围18 pm/r 的波长调谐。

关键词: 遥感 转动拉曼激光雷达 全光纤分光系统 光纤布喇格光栅 悬臂梁调谐

Research on spectroscopic technique of fiber Bragg grating for all-fiber rotational Raman lidar

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Abstract:

An all-fiber rotational Raman lidar spectroscopy constructed by fiber Bragg grating and fiber coupler in visible region is designed. The fiber Bragg grating with 530-nm central wavelength is successfully fabricated through phase mask directly inscribing, and then its transmissivity and reflectivity are experimentally tested. The high tuning sensitivity cantilever system is designed to enhance the matching performance between the central wavelength of fiber Bragg grating and the rotational Raman spectral line of atmosphere molecules. The experimental results show that the fiber Bragg grating in visible region successfully fabricated possesses 95% reflectivity and 0.3-nm full width at half maximum, and that the strain tuning system may possess sensitivity of 18 pm/r within the ± 0.6 nm range.

Keywords: remote sensing rotational Raman lidar all-fiber spectroscopy fiber Bragg grating cantilever tuning

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参考文献:

[1] Hill K O. Photosensitivity in optical fiber waveguides: from discovery to commercialization

[J]. IEEE Journal of Selected Topics in Quantum Electronics, 2000, 6(6): 1186-1189.

[2] Hao Wenliang, Zhen Shenglai, Cao Zhigang, et al. A fiber Bragg grating interrogating dynamic strains sensor system based on interference of polarized mode

[J]. Chinese Journal of Quantum Electronics(量子电子学报), 2012, 29(4): 507-512 (in Chinese).

[3] Vann L B, DeYoung R J, Mihailov S J, et al. Narrowband fiber-optic phase-shifted Fabry-Perot Bragg

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[J]. Applied Optics, 2005, 44(34): 7371-7377.

[4] Mao Jiandong, Hu Liaolin, Hua Dengxin, et al. Pure rotational Raman lidar with fiber Bragg grating for temperature profiling of the atmospheric boundary layer

[J]. Optica Applicata, 2008, 38(4): 715-26.

[5] Li Shichun, Hua Dengxin, Song Yuehui, et al, Research on micro-lens coupling system of all-fiber Raman lidar

[J], Acta Optica Sinica(光学学报), 2011, 31(6): 0601001 (in Chinese).

[6] Li Shichun, Hua Dengxin, Song Yuehui, et al, Fiber coupling system of space optical field based on aspheric lens

[J], Acta Photonica Sinica(光子学报), 2012, 41(9): 1053-1058 (in Chinese).

[7] Lindner E, Becker M, Rothhardt M, et al. Generation and characterization of first order fiber Bragg gratings with Bragg wavelengths in the visible spectral range

[J]. Optics Communications. 2008, 281: 4612-4615.

[8] Carver G E, Farkas D L, Porque J, Feder K S, Westbrook P S. Visible Wavelength Fiber Bragg Grating Arrays for High Speed Biomedical Spectral Sensing. Bragg Gratings, Photosensitivity, and Poling in Glass Waveguides: Optical Society of Americaed, 2010: BThB5.

[9] Erdogan T. Fiber grating spectra

[J]. Journal of Lightwave Technology. 1997, 15(8): 1277-94.

[10] Qin Zixiong, Zeng Qingke, Xiang Yang, et al. Grating wavelength shifter with a broad-range tunability by using a beam of uniform strength

[J]. Acta Optica Sinica(光学学报). 2001, 21(12): 1421-1425(in Chinese).

[11] Zhao Henglei, Feng Sujuan, Wang Huijuan, et al. Development of fiber Bragg grating filter based on axial compression technique

[J]. Chinese Journal of Quantum Electronics(量子电子学报), 2011, 28(3): 375-379 (in Chinese).

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[J]. 量子电子学报, 2009,26(3): 268-271

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量子电子学报, 2009,26(5): 624-630

3. 刘秉义, 冯长中, 陈玉宝, 高玉春, 陈超, 张冰, 靳磊, 闫宝东, 刘智深.车载测风激光雷达风廓线同步观测实验[J]. 量子电子学报, 2013,30(1): 52-56

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5. 王瑾, 张镭, 王宏斌, 刘瑞金, 周碧, 黄忠伟, 闭建荣, 张北斗, 张武.西北半干旱区激光雷达探测卷云几何特征和光学厚度[J]. 量子电子学报, 2013,30(1): 66-72

6. 马晓珊 孟新 杨震 彭晓东 谢文明.光学遥感成像系统全链路仿真框架研究[J]. 量子电子学报, 2012,29(4): 392-399

7. 王玉峰, 华灯鑫, 王红伟, 狄慧鸽 .基于光纤F-P滤波器的全光纤水汽拉曼激光雷达系统的设计与分析[J]. 量子电子学报, 2013,30(1): 103-109

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9. 魏书晓, 吴东.利用星载激光雷达研究云层垂直结构及其分布[J]. 量子电子学报, 2013,30(1): 36-41