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SOI纳米波导的优化制备与弯曲损耗测试

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摘　要：

本文主要针对目前SOI（Silicon-on-insulator）纳米光波导结构弯曲损耗严重的问题，系统地进行了理论仿真分析，设计出最佳的纳米波导结构，并采用ＭＥＭＳ工艺对其进行加工制备与优化处理。后利用了SEM（扫描电子显微镜）、AFM（原子力显微镜）、透射谱功率法等研究手段精确测试了在高纯氮退火和BOE腐蚀后处理不变的情况下，不同温度热氧化退火处理下的波导侧壁粗糙度和对应的弯曲损耗，结果表明：波导的侧壁粗糙度随退火温度的变化近似呈二次抛物线变化趋势，在900℃附近达到最低值2.1nm，对应的半径15μm的环形波导的弯曲损耗为0.0109±0.001dB/turn，其损耗值与理论分析结果一致。利用这一结论就可以通过选择不同的优化处理条件来减小环形波导的弯曲损耗，从而实现光能量的高效传输。

关键词：SOI；纳米光波导；MEMS；粗糙度；弯曲损耗

Optimizations fabrication and test of bending loss of the SOI nano-waveguide

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Abstract:

The paper mainly aimed at a serious bending loss problem of SOI nano-waveguide structure, conducted a theoretical simulation analysis systematically, schemed out the best nano-waveguide structure, and made use of the MEMS technology on the fabrication and processing of optimization. Then this work made a precise testing of the roughness of waveguide sidewall and the corresponding bending loss after annealing treatment of thermal oxidation of different temperature, under the same circumstances of high-purity nitrogen annealing and BOE corrosion post-processing, by the means of the SEM (scanning electron microscope), AFM (atomic force microscope) and transmission spectrum power method. It turned out that the sidewall roughness of the waveguide changes along with the annealing temperature in a quadratic approximation parabolic trend and reaches the lowest value 2.1nm around 900℃ where the corresponding radius is 15μm and the circular waveguide bending loss is 0.0109±0.001dB/turn, which shows loss value and the theoretical analysis results are consistent. To realize efficient transmission of light energy, we can choose different optimization disposal conditions to reduce the circular waveguide bending loss by taking advantage of this conclusion.

Keywords: Silicon-on-insulator；Nanophotonic waveguide；MEMS；Roughness；Bend loss

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