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论文

聚合酶链式反应微流控芯片的准分子激光制备和应用研究

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摘要:

摘要采用价格便宜的聚甲基丙烯酸甲酯(PMMA)代替价格昂贵的硅或玻璃作为聚合酶链式反应(PCR)微流控芯片的基片材料,采用柔性大且自动化程度高的准分子激光微加工方法代替加工工艺复杂的光刻化学腐蚀方法,在19 kV和18 mm/min的优化加工参数下,在48 mm×67 mm×1 mm的PMMA基片上制备出20个循环的PCR微流控芯片. 芯片微通道横截面呈梯形,底面光滑. 微通道宽104 μm,深56 μm,长2 060 mm,加工耗时约110 min. 该芯片和相同尺寸的盖片在160 N和105 ℃条件下通过热压经20 min键合在一起,键合强度为0.85 MPa. 键合后的芯片和温控系统集成在一起,采用比例积分微分(PID)方法得到的控温精度为±0.2 ℃,采用红外热像仪得到的相邻温区间的温度梯度分别为16.5和22.2 ℃,最后利用该芯片在对170 bp的DNA片段实现了体外扩增.

关键词: PMMA; PCR微流控芯片; 准分子激光

Fabrication of Micro Flow Through PCR Chip by Excimer Laser and Its Application

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Abstract:

A cheap PMMA was chosen as the substrate instead of expensive silicon or glass,and a 248 nm excimer laser with flexible and auto character replaced complex lithography as a new fabrication technique. A PMMA(48 mm×67 mm×1 mm) based micro flow through PCR chip with 20 cycles was fabricated at 19 kV and 18 mm/min excimer laser parameters. The section of the microchannel was trapezoid,and its bottom surface roughness was less than 0.5 μm. The microchannel had a width of 104 μm,a depth of 56 μm,and a length of 2 060 mm. It cost about 110 min to finish the total length. Then the chip was bonded together with another cover chip at 105 ℃,160 N and 20 min parameters. It could endure 0.85 MPa pressure and seal micro fluid well after sample injection experiment. In the end,the chip was integrated via the temperature control system. Three micro PID temperature controllers were chosen to control the temperature and gained ±0.2 ℃ temperature control precision. The temperature grads between the three temperature zones were 16.5 and 22.2 ℃,respectively. Finally 170 bp DNA fragments was amplified by using this chip.

Keywords: PMMA; Micro flow through PCR chip; Excimer laser

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