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微纳技术与精密机械

半月形电极微液滴驱动微流控芯片

许晓威, 陈立国*, 孙立宁

苏州大学 机器人与微系统研究中心, 江苏 苏州 215021

摘要: 针对目前数字微流控芯片驱动电压比较高的问题, 本文对比传统的驱动电极结构, 研制了一种可以降低驱动电压的半月形驱动电极数字微流控芯片。首先, 基于介电湿润原理, 分析微液滴所受介电湿润力和微液滴接触圆上有效三相接触线所对应弦长的关系。接着, 对比分析了传统的方形、叉齿形驱动电极与提出的半月形驱动电极上液滴有效三相接触线所形成的弦长大小; 分析得出3种驱动电极结构中半月形驱动电极所形成的有效弦长最大, 从而表明半月形驱动电极的数字微流控芯片上介电驱动力最大。最后, 利用设计制作的3种驱动电极介电湿润芯片分别实验验证驱动液滴的效果。结果表明, 所研制的半月形驱动电极数字微流控芯片的最小驱动电压分别比方形和叉齿形驱动电极芯片降低了约37%和67%。另外, 当有效驱动电压为60 V时, 半月形驱动电极芯片上2 μ L去离子水微液滴的速度约为10 cm/s, 分别是方形与叉齿形驱动电极芯片上液滴速度的3倍和2倍。得到的实验数据证明了半月形驱动电极数字微流控芯片实现了降低芯片驱动电压的目的。

关键词: 数字微流控芯片 介电湿润 微液滴 半月形电极 有效驱动电压

Micro-droplet driven digital microfluidics device with crescent electrode

XU Xiao-wei, CHEN Li-guo*, SUN Li-ning

Robotics & Microsystem Center, Soochow University, Suzhou 215021, China

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通讯作者: 许晓威

作者简介: 许晓威(1984-), 男, 河南息县人, 博士研究生, 2008年于东南大学获得学士学位, 主要从事数字微流控芯片方面的研究。

作者Email: 851597503@qq.com

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