2016 中技社科技研究獎學金

CTCI Science and Technology Research Scholarship

以短波長脈衝雷射直寫與混紡奈米線技術於即時核酸增幅檢測之研究

Study of Real-Time Nucleic Acid Amplification Tests Using laser Direct-Writing and Hybrid Electrospun Nanofiber Techniques

國立臺灣師範大學 機電工程學系

博士班三年級 陳肇祈　指導老師：張天立 教授

Corresponding

E-mail: tlchang@ntnu.edu.tw

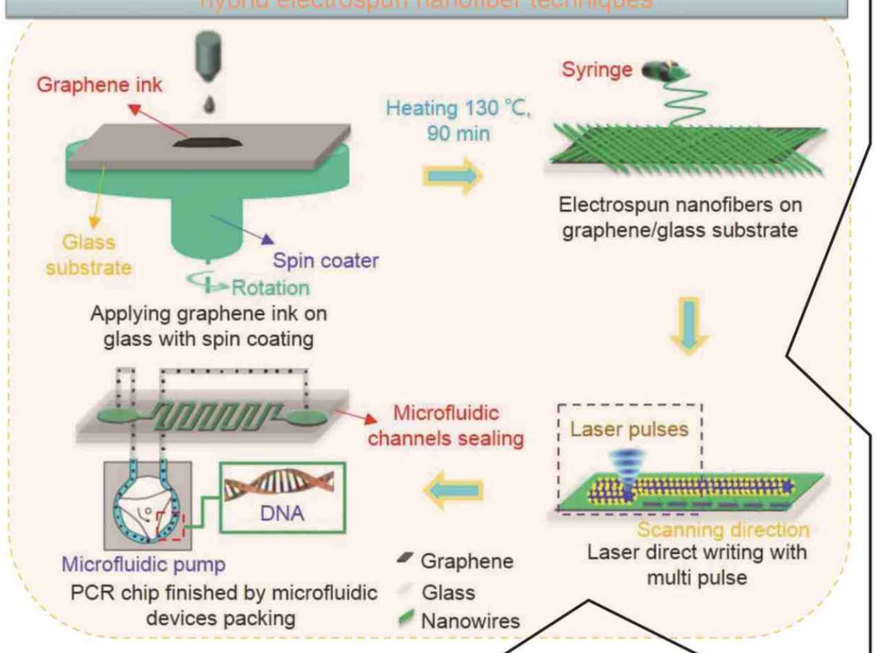
kanon2107@hotmail.com

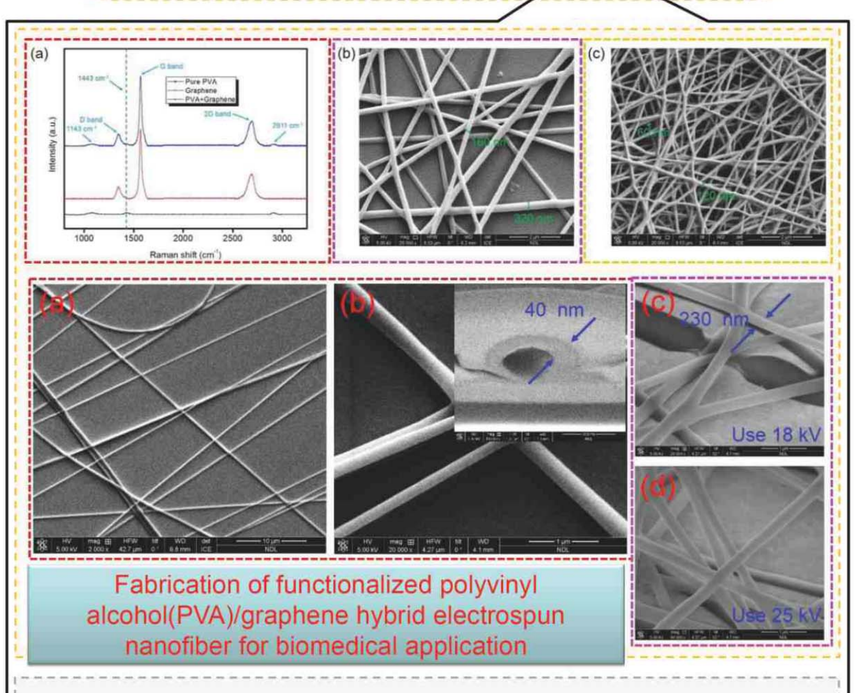
研究重點

With the rise of science and technology, the chronic and hereditary diseases will be discussed to a deeper level. The study is to focus on the Polymerase Chain Reaction (PCR) microfluidic device detection for the DNA and genetic defect. Based on the design and fabrication of the μPCR chip structures with the mechanism of molecular aggregation and separation, which using laser direct writing and hybrid electospun nanofiber techniques to form electrode, sensing area and microfluidic channel. To improve the detection sensitivity and stability, the study can fabricate the polyvinyl alcohol (PVA)/graphene network composites nanofiber on the graphene-based electrode structures within the μPCR chip. In this results, the glucose response can be obviously found that the change of electrical resistance can measured the glucose at the lowest concentration of 0.011 mM in biomolecular test, Moreover, the electrodes, microfluidic structures and functionalized nanofibers were succeed fabricated by an energy saving, environmental protection processes of laser patterning and electrospinning. Furthermore, the graphene-based micro heater show clearly maximum temperature distribution around 93.6 ℃ after laser ablation, it can establish a new process technique platform to develop the μPCR-on-chip of detection for DNA molecular.

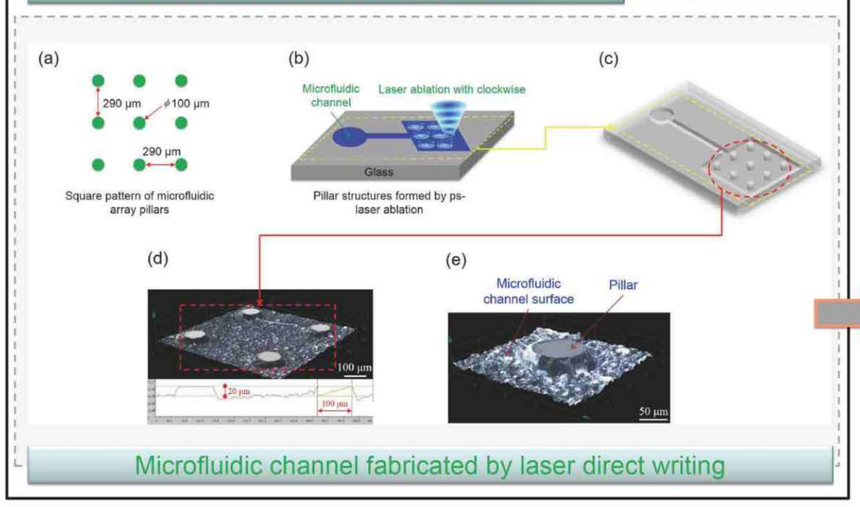
研究成果

Schematic diagram of μPCR chip fabricated with laser direct-writing and hybrid electrospun nanofiber techniques

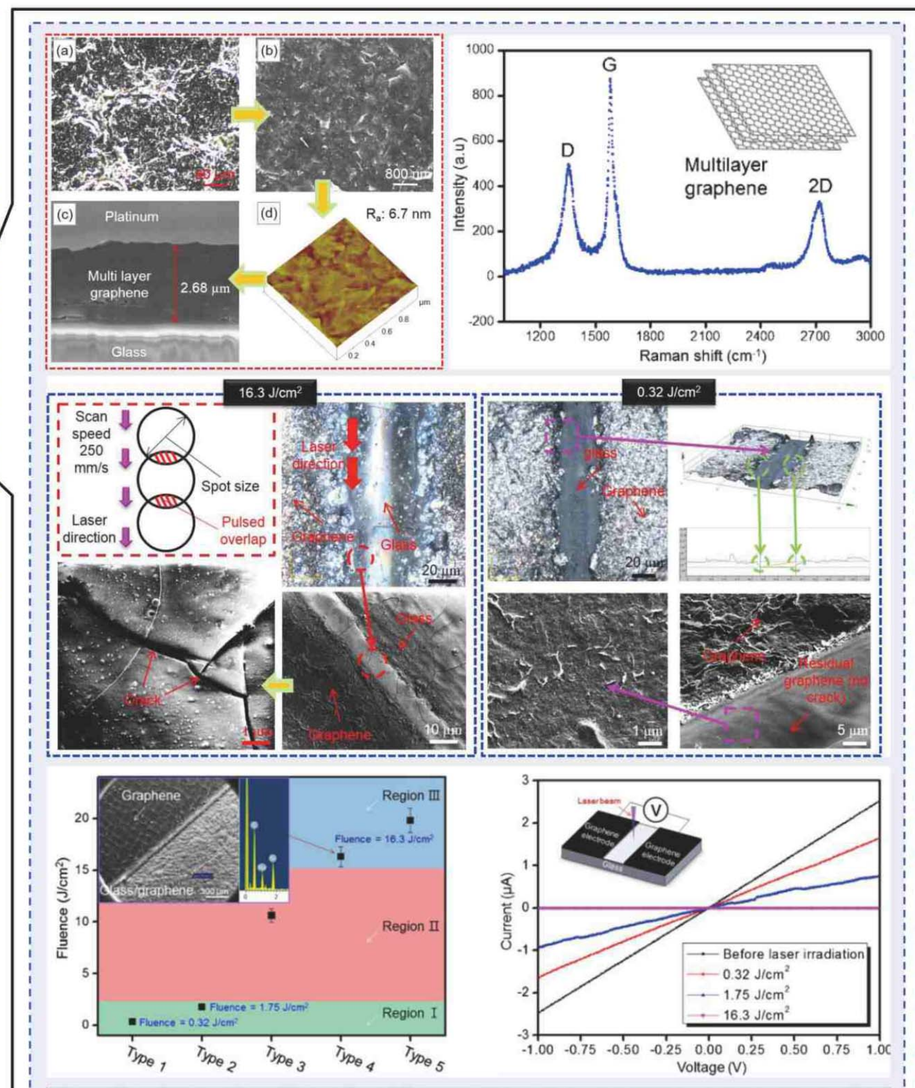




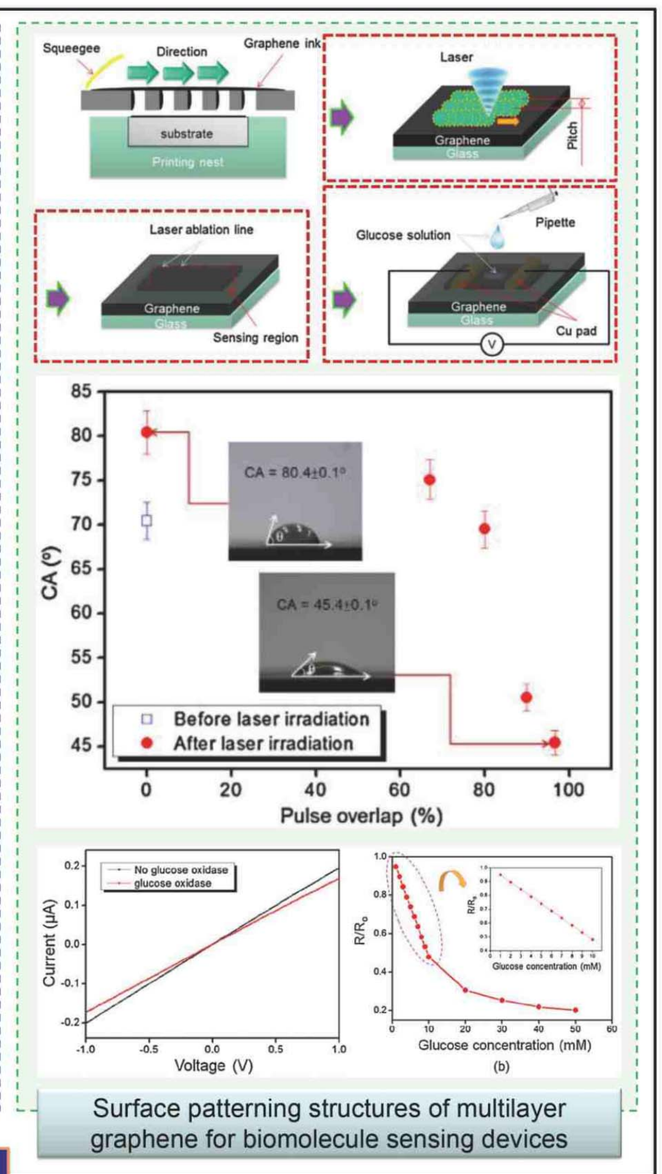
Fabrication of functionalized polyvinyl alcohol(PVA)/graphene hybrid electrospun nanofiber for biomedical application



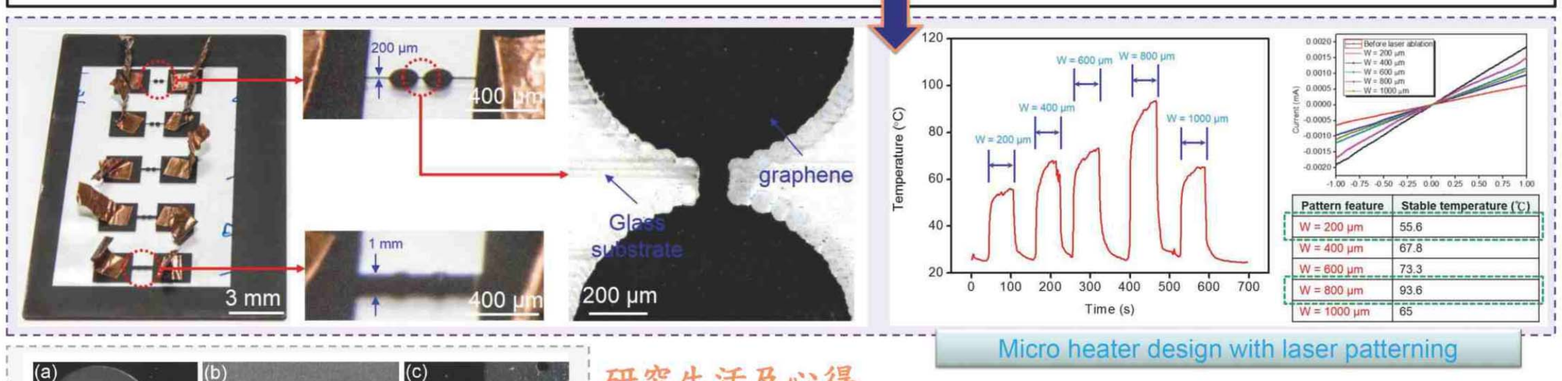
Microfluidic channel fabricated by laser direct writing



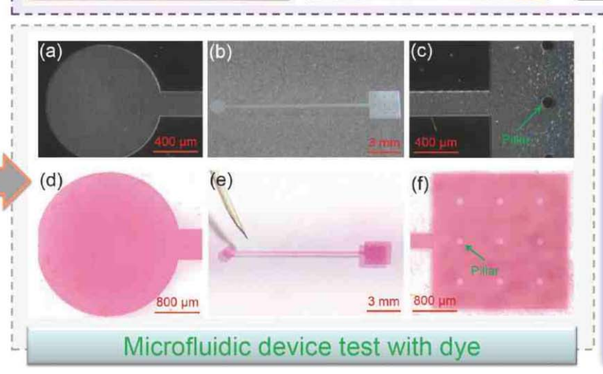
Laser direct writing multi-layer graphene for forming electrode structures



Surface patterning structures of multilayer graphene for biomolecule sensing devices



Micro heater design with laser patterning



Microfluidic device test with dye

研究生活及心得

很榮幸也很感謝中技社能給肇祈這個機會，同時感激我的指導教授張天立老師長久以來用心教導。這一路走來，肇祈秉持高斯的一句話：「給我最大快樂的，不是已懂的知識，而是不斷的學習。不是已有的東西，而是不斷獲取。不是已達到的高度，而是繼續不斷的攀登。」肇祈願加倍努力，飲水思源且積極進取，無論處在何處皆竭盡心力貢獻所長，並以身為台灣的研究學者為傲。