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Laser Based Microfabrication of a Microheater Chip for Cell Culture

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Abstract : Microfluidic chips have demonstrated their significant application potentials in microbiological processing and chemical reactions, with the goal of developing monolithic and compact chip-sized multifunctional systems. Heat generation and thermal control are critical in some of the biochemical processes. The paper presents a laser direct-write technique for rapid prototyping and manufacturing of microheater chips and its applicability for perfusion cell culture outside a cell incubator. The aim of the microheater is to take the role of conventional incubators for cell culture for facilitating microscopic observation or other online monitoring activities during cell culture and provides portability of cell culture operation. Microheaters (5 mm × 5 mm) have been successfully fabricated on soda-lime glass substrates covered with aluminum layer of thickness 120 nm. Experimental results show that the microheaters exhibit good performance in temperature rise and decay characteristics, with localized heating at targeted spatial domains. These microheaters were suitable for a maximum long-term operation temperature of 120ºC and validated for long-time operation at 37ºC. for 24 hours. Results demonstrated that the physiology of the cultured SW480 adenocarcinoma of the colon cell line on the developed microheater chip was consistent with that of an incubator.

Keywords : laser microfabrication, microheater, bioengineering, cell culture
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