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DESIGN, FABRICATION AND CHARACTERIZATION OF MICRO-REACTORS FOR BIODIESEL SYNTHESIS

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Abstract

In this study, a novel method is presented for the microfabrication and sealing of a microfluidic device to perform the role of a micro-reactor for biodiesel synthesis, built on a brass metal base and sealed with either a metal cover or a glass cover for easy microscopic observation of the two-phase flow patterns. The microfluidic device contains a Y-junction squared microchannel architecture with width and depth of 400 μm. Microchannels were engraved using a micro-milling technique and sealed either by welding, with tin as an addition material, in the case of the all metal device or by using an epoxy glue, which served as an adhesive to seal the metal-glass device. The quality of the metal-on-metal seal was examined using microscopic analysis of multiple cross-sections of the device, whereas the quality of the metal-on-glass seal was analyzed via direct visual inspection of flows within the device using an optical microscope to verify the existence or absence of leaks. This method provides a quick, simple, and economic way to fabricate microfluidic devices for use in industrial applications, such as in the production of biodiesel, which require high temperatures, high pressures, relatively high chemical resistance, and in addition, in the case of the metal-glass device, the ability to directly visualize flow processes.