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<AT>Fabrication of porous copper surfaces by laser micromilling and their wetting properties
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<ABS-HEAD>Highlights► Laser micromilling method is introduced to fabricate porous copper surfaces (PCS) ► Effects of processing parameters on formation and surface morphologies of PCS are accessed ► The wettability of the porous copper surfaces was also evaluated

<ABS-HEAD>Abstract
<ABS-P>Porous copper surfaces show their great merits in the applications of chemical reaction, sound absorption and heat transfer. In this study, a laser micromilling method is proposed to fabricate porous surfaces with homogeneous micro-holes and cavities of the size about 1~15μm on pure copper plates in a one-step process. The laser micromilling was performed by a pulsed fiber laser via the multiple–pass reciprocating scanning strategy. Based on the measurement of scanning electron microscope (SEM) and 3D laser scanning confocal microscope, the formation of surface structures was investigated together with the laser ablation mechanisms. The effects of laser processing parameters, i.e., laser fluence, scanning speed, number of scanning cycles and scanning interval, on the formation and surface morphology of porous surfaces were systematically assessed. Furthermore, the wettability of the porous copper surfaces was also evaluated by measuring the static contact angle of water. The results showed that the laser fluence played the most significant role on the formation of porous copper surfaces. The average depth and surface roughness of porous copper surfaces increased with increasing the laser fluence and number of scanning cycles while decreased with the increase in scanning interval. The scanning speed played little influence on the formation of porous copper surfaces. These results can be closely related to the variation of energy density and re-melting process during the laser micromilling process. Moreover, all the copper porous surfaces were found to be hydrophobic. The contact angle of porous copper surfaces was significantly dependent on laser fluence, but weakly affected by the scanning speed and number of scanning cycles.
<KWD>Keywords: Porous copper surface; laser micromilling; surface morphology; roughness; wettability

<H1>1. Introduction
Porous copper surfaces with micro-pores have been widely utilized in many fields, e.g., chemical reaction, sound absorption and heat transfer[1-3]. Their large surface area, good performance of sound absorption, and excellent thermal properties make them as good candidates for catalyst support for microreactors [4], sound absorption medium [2], wicks of heat pipes [5] and heat transfer surface in two-phase heat sinks[6]. To date, several methods, such as sintering, foaming, electrodepositing and painting means, have been developed to fabricate porous copper surfaces. Weibel et al. [5] prepared copper powder surfaces by sintering to supply as the wick of heat pipes and vapor chambers. The excellent heat transfer capacities of these sintered powder wicks have been experimentally demonstrated. Ru et al. [2] fabricated porous copper surfaces using a resin curing and foaming method. Good sound absorption performance of these porous copper were obtained. El-Genk and Ali [6] fabricated

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