PCB AND NANOFIBERS PRODUCTION AS A STRATEGIC FOR INCREASING PROCESS INTENSIFICATION

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1. Introduction

Process Intensification (PI), a well defined strategy for improvement of Chemical Engineering Processes, has been benefitted from the miniaturization tendencies that occurred on the last few decades. Miniaturization has also allowed the emerging of new fields in Chemical Analysis and Synthesis, with some of these miniaturized devices been produced by Printed Circuit Board (PCB) processes even in flexible laminates [1]. Moreover, nano and microfibers deposited inside microchannels may lead to obtaining of high capacity microreactor; therefore, this work aims the development of such structures.

2. Experimental

The "S" shape microreactor is well known, however, variations in its dimensions can lead to unexpected fluid behavior; therefore, such microreactors were simulated using Fem Lab 3.2® software. Project used CAD software, and microchannels have been defined in common copper-clad PCB laminates, by galvanic process as copper electroplating. Deposition of micro and nanofibers was carried out on a homemade electrodynamic focusing setup and using electrospinning of polymeric solutions [2]. Sealing of microchannels makes use of adhesive tape. Optical microcopy was used for device visualization.

3. Results and Discussions

Figure 1a shows CAD design; whereas depth and width were fixed at 35 μm and 100 μm, respectively, length varied in 10, 20, or 30 mm and distance from channels in 200 μm or 500 μm. Figure 1 b points out typical simulated fluid behavior; for small devices (1 mm length, distance from channels = 200 μm) vorticity is high on the curved structures For 20 mm microchannels (Figure 1c) velocity is constant on the straight part of the structure. These fluid conditions indicate that longer channels are useful for reaction and shorter ones as mixers. Deposition of fiber inside of both channels can increase surface to volume ration and improve performance. The use cooper channels favors deposition inside the channels because the density of the electric field on the bottom is increased (Figure 1d). Figures 1e and 1f show photos of the copper channels.
It is worthy point out that the whole production (from setup to microchannel) was based on PCB processes, which indicates this technology as relevant for PI; however up to now low efforts are made in this regard.

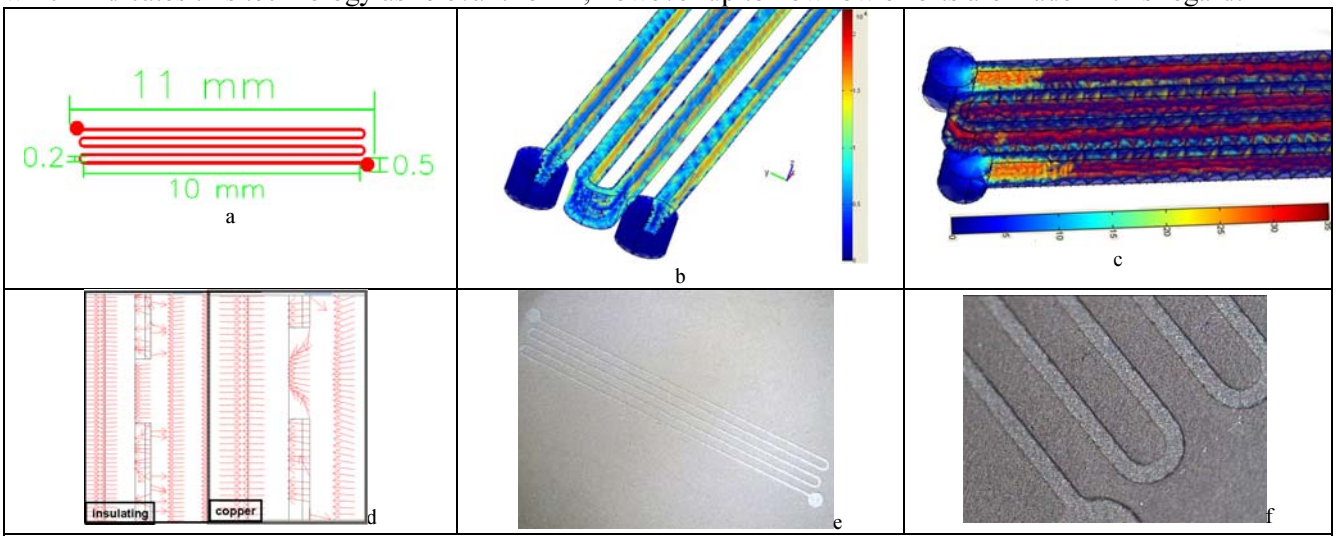

Fig. 1. *Microchannels: (a) CAD; (b) vorticity (s-1) on channels 10 mm length distant 200 μm; (c) velocity (cm/s) on channels 20 mm length distant 200 μ.; (d)electric field on insulating and copper channels; (e), (f) photos of the channel*

4. References

[1]- Y-C. Tsai et al, Journal of the Chinese Chemical Society, **53**, 683-688, (2006).
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Micropress for PCB manufacturing.

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