Liquid Membrane Electrochemical Etching: Twin Nano-Tips Fabrication for Micromachining

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Nano-electrodes are essential components in electrochemical micromachining, allowing high machining accuracy and minimum machining size. Liquid membrane electrochemical etching processes twin nano-electrodes with parabolic upper and conical lower nano-electrodes simultaneously. After the lower tip drops off, blunting due to residual current increases the diameter of the upper tip. This blunting can be decreased by cutting off the residual current in 5 ms with a newly developed control strategy. Experimental results indicate that the diameters of both nano-electrodes decrease with the use of lower voltage and electrolyte concentration and shorter lower-end length. To avoid low etching efficiency or a boiling effect, appropriate parameters should be selected. Blunting can also be reduced by using lower voltage and electrolyte concentration. Twin nano-electrodes with upper- and lower-tip diameters of 110 and 80 nm, respectively, have been fabricated and used to make micro-holes of 2 μm diameter by electrochemical micro-drilling.

Keywords: Electrochemical etching; Liquid membrane; Nanoelectrode; Blunting; Cut off

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