In-Situ Fabrication of Tube Electrodes with Array Slits using Multi-Wire Electrochemical Machining

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Wire electrochemical machining using an inner-jet electrolyte is an efficient cutting method of thick workpieces. A tube electrode with array slits is used, the electrolyte is sprayed directly from the array slits onto the machining gap and the electrolysis products are flushed out rapidly. An efficient and high-precision in-situ fabrication method is proposed for fabrication of the array slits structure of tube electrodes. Using electrochemical machining, the array slit structure is machined on a metal tube wall using multiple metal wires as the tool cathode. The effects of voltage, duty cycle, pulse frequency and electrolyte concentration on array slit width and depth are investigated experimentally, and optimal machining parameters obtained. A tube electrode with an average slit width of 218.6 μm and depth of 270.7 μm is successfully fabricated on stainless steel tube with an external diameter of 0.7 mm and the wall thickness of 0.15 mm. The cutting experiment is completed on 20 mm thick stainless steel 304 using this fabricated tube electrode at a 5 $\mu\text{m/s}$ feed rate. Three slits with an average width of 1.215 mm are successfully machined.

Keywords: tube electrode with array slits; situ fabrication; multi-wire ECM; WECM using a tube electrode

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