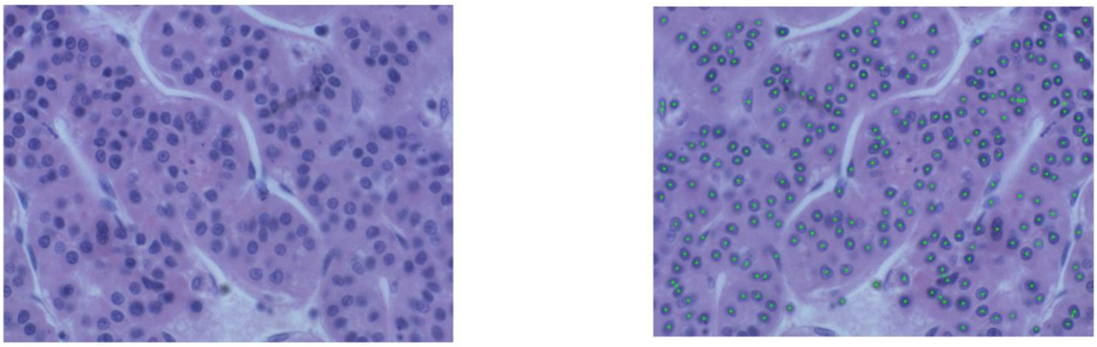

Figure 3 – Detection results on the liver cancer pathology image. Left: original image. Right: detection result

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УДК 004

EXPERIMENTAL INVESTIGATION ON LOW SPEED WIRE ELECTRICAL DISCHARGE TURNING AND ITS APPLICATION IN FABRICATING MICRO PARTS

Yao Sun
School of Mechanical Engineering and Automation, Northeastern University, Shenyang, China
E-mail: sy547515291@163.com

Abstract. *This paper firstly proposed the method of the low speed wire electrical discharge turning (LS-WEDT) method to fabricate micro parts. Firstly, the rotating apparatus submerged in working fluid is designed and manufactured to enable the low speed wire electrical discharge machine to generate cylindrical geometries. Besides, material removal rate, surface roughness and machining precision of micro shafts manufactured by the LS-WEDT are respectively investigated. Experimental results display that the micro-rod of 70μm in diameter and 1000μm in length can be successfully fabricated with high machining precision and good surface quality of the micro shaft.*

1. Introduction

Wire electrical discharge machining (WEDM) is a thermoelectric process which can remove material by a series of electrical sparks generated between the workpiece and tool electrode [1]. The non-contact and negligible cutting force of the EDM process make it have the unique superiority in fabricating micro parts and components. With micromechanics and micro-electro-mechanical system have come to a practical period, the demand for micro parts and components with the diameter range of 10μm and 1mm is significantly increased, such as micro gear shafts, mechanical and electrical contact probes, instrument probes, micro-ejector pins and micro-tools.

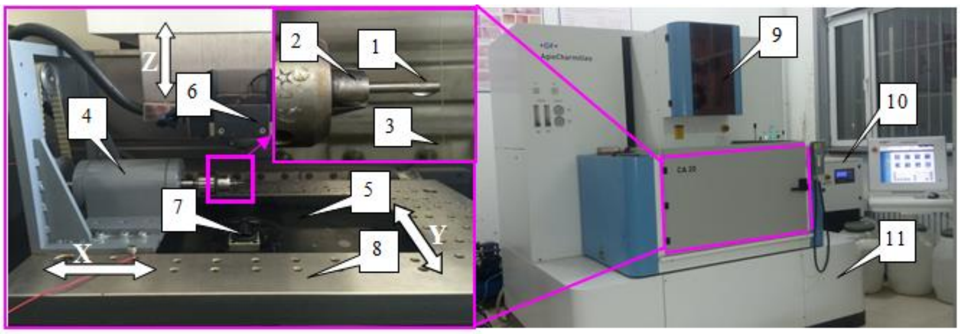
Zhao *et al*. [7] used the block electrode discharge grinding method to fabricate micro rods at a high machining speed, but the dimensional accuracy is poor because of the block electrode wear.

Haddad *et al*. [10] investigated the effect of voltage, power, rotated speed and pulse off time on MRR, surface roughness and roundness in WEDT. Mohammadi *et al*. [13] investigated the effects of machining parameters on MRR of WEDT using the analyses of variance (ANOVA) and reported that the rotating speed is the least significant parameter affecting the MRR.

From researching summary of above, there is no previous investigation concerning using the WEDT method to successfully fabricate micro shaft of diameter below 100 μm. Therefore, the flexible manufacture of micro parts is a challenge in terms of production engineering. Therefore, this paper aims at fabricating micro parts by electrical discharge machining method.

2. Methods

The LS-WEDM machined is CA20 made by Beijing Agie Charmilles Industrial Electronics Co., Ltd as displayed in Fig.1. The rotating apparatus is fixed on the workbench of LS-WEDM machine for fabricating the micro shafts. The rotating apparatus is constituted by servo motor, timing belt, precise spindle, pulley, seal ring, carbon brush, chuck, etc. The working fluid is the deionized water and wire electrode is the 200μm-diameter brass wire. The fabrication of micro shafts are divided into rough cut (RC), trim cut (TC)and finshing trim cut (FTC), and machining parameters are detailed in Table 1.



1.Workpiece
2. Chuck
3. Brass wire
4. The rotating apparatus
5. Deionized water
6. The upper guide
7. The lower guide
8. Working table
9. Movement wire device
10. Electric cabinet
11. Water tank

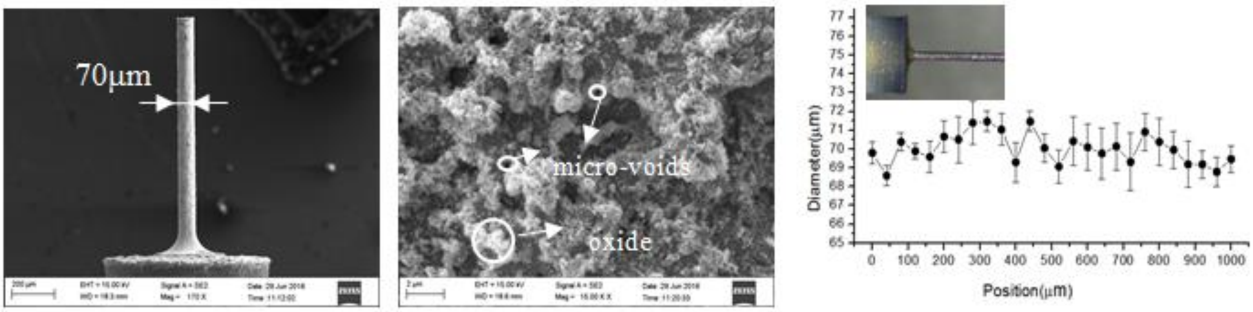
Figure 1 – The experimental platform

Table 1 – Machining parameters and levels of multiple cuts

Parameters	Unit	Rough cut	Semi-finishing trim cut		Finishing trim cut
		RC	TC1	TC2	FTC
Peak current	A	320	180	120	40
Open voltage	V	170	136	100	85
Pulse on time	μs	15	13	10	4
Pulse off time	μs	25	25	25	25
Rotating speed	r/min	20	20	20	20
Wire tension	N	12	15	18	18
Wire speed	m/min	1.8	2.7	3.6	4.5
Servo feed speed	mm/min	0.01	0.01	0.01	4
Flushing pressure	Kg/cm^2	10	1	0.3	0.3

3. Experiment Results

The micro shaft with the average diameter of 70μm is obtained after FTC as displayed in Fig.2 (a). The surface of micro shaft after FTC is covered with a large amount of oxide particles instead of uneven fusing structure, big craters and spherical droplets as shown in Fig.2 (b). More importantly, the machining precision of the micro shaft is very high with the mean absolute deviation of 0.65μm and maximum absolute deviation of 1.46μm as displayed in Fig.2 (c).



(a) Micro shaft after FTC (b) Enlarged view (c) The diameter consistent accuracy

Figure 2 – The experimental results

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УДК 502.3

РЕАЛИЗАЦИЯ МАТЕМАТИЧЕСКОЙ МОДЕЛИ ПРОГНОЗИРОВАНИЯ ПОСЛЕДСТВИЙ АВАРИЙНОГО ПРОЛИВА НЕФТЕПРОДУКТОВ

Бурмакова А.В., Блинова Е.А., Смелов В.В.
Белорусский государственный технологический университет
e-mail: isit@belstu.by

Abstract. *Together with the Republican Unitary Enterprise "Research and Production Center for Geology" and the "Institute of Nature Management of the National Academy of Sciences of Belarus" (Institute of Nature Management), a mathematical model was developed for predicting the consequences of an emergency spill of oil products. A mathematical model is the basis of the ecological expert system developed by the specialists of the Belarusian State Technological University within the framework of the agreement with the "Research and Production Center for Geology" on geology.*

The purpose of creating an expert system is to support decision-making on the selection of optimal geological environment rehabilitation technologies in terms of environmental and economic efficiency. The expert system can be used by a wide range of users: from managers of facilities where oil products are handled and there is a possibility of contamination, to the staff of the relevant departments, such as emergency response agencies, nature protection, etc.

Совместно с Республиканским унитарным предприятием «Научно-производственный центр по геологии» (НПЦ по геологии) и «Институтом природопользования Национальной академии наук Беларуси» (Институт природопользования) была разработана математическая модель прогнозирования последствий аварийного пролива нефтепродуктов (МП). МП является ос-