Stability of micro dry wire EDM: OFAT and DOE method

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Abstract

Micro dry wire electrical discharge machining (mu DWEDM) is an environmental-friendly machining process where gas is used as the dielectric fluid instead of liquid. In this process, certain modifications of wire electrical discharge machining (WEDM) are required during the machining operation for stable machining. In mu DWEDM, the process is considered stable if the machining is continuous without any interruption due to wire breakage or wire lag. However, in the present state of the arts, stable and smooth machining process using mu DWEDM remains a critical issue. Hence, the objectives of this research are to establish a stable mu DWEDM process using two different experimental approaches: one-factor-at-a-time (OFAT) and design of experiment (DOE) method. The investigation was performed on a stainless steel (SS304) with a tungsten wire as the electrode using integrated multi-process machine tool, DT 110 (Mikrotools Inc., Singapore). Types of dielectric fluid, dielectric fluid pressure, polarity, threshold voltage, wire tension, wire feed rate, wire speed, gap voltage, and capacitance were the controlled parameters. The machining length of the microchannels was measured using scanning electron microscope (SEM) (JEOL JSM-5600, Japan). Analysis based on these two experimental approaches shows that stable mu DWEDM process is achievable when the types of dielectric fluid, dielectric fluid pressure, polarity, threshold voltage, wire tension, wire feed rate, and wire speed remain as the fixed parameters while the capacitance and gap voltage remain as the controlled parameters.

Keywords

Author Keywords: Dry EDM; DEDM; DWEDM; mu DWEDM; OFAT; DOE; Plackett-Burman design
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