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Experiment analysis of EDM Processes parameters for Turning of EN31 automobile Bearing Steel materials Using Tool Rotation

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Abstract--- Electrical Discharge Machine is commonly used non-traditional machining process to machine high strength advance materials which are difficult to machine. The present research investigates the effect of tool rotating speed to the responses viz. MRR, TWR and surface roughness (Ra) of Electric Discharge Machine (EDM) processes viz. EDM, Dry-EDM, Near Dry EDM which used the liquid, gas and liquid-gas dielectric respectively. It is found that the increased in tool rotating speed increases MRR then decreases. It is also found that increase in tool rotating speed decreases Surface roughness (Ra). TWR for Dry-EDM and ND-EDM compared to Wet EDM is negligible..

Keywords--- EDM, Dry EDM, ND-EDM, Tool Rotation Speed, MRR, TWR, Ra

I. Introduction and Literature Review

Electrical discharge machining (EDM) is a commonly used non-traditional machining process to produce dies, molds, automotive industry and also surgical components [1]. It was first developed in the late 1940s [2] where material removal is done by series of electrical discharges between tool and the work piece within a dielectric medium [3]. EDM does not make any direct contact between the electrode and the work piece that can eliminate mechanical stresses and vibration problems. In EDM process, electrical energy is converted into thermal energy that creates plasma channel of temperature 8000- 12000˚C between the tool and workpiece which is
sufficient to melt the workpiece and the tool. The plasma channel spreads and causes and jumping out of the molten materials are jumping out from the workpiece and tool surfaces when a sudden drop in temperature by cutting off the pulse energy. The erosive effect of the electrical discharges is the key role to remove material from the In dry EDM, high-pressure air or gas such as air, oxygen, helium, nitrogen, and argon is supplied through the hollow tool electrode as a dielectric fluid [5]. The gas is injected inside the tool electrode with high pressure, which removes melted material from the working gap and cools down the tool electrode and the work piece. The role of the gas is to withstand as insulator and remove the debris between tool and work piece. It also use as a coolant for tool and work piece. However, low stability of arc column as compared to wet EDM is the Dry EDM process limitation [6]. First investigation of ND-EDM was carried out by Tambura et al. in 1989 [7]. The near-dry EDM process used a liquid dielectric is replaced by a mixture of gas and liquid dielectric. In 2007, Kao et al. was carried a meaningful investigation to study the effects of the electrode material and dielectric medium for roughing and finishing operations after first investigation. The dielectric is flushing through the hollow tool at high speed on the work piece surface [8]. In the present investigation, effect of tool rotating speed to the responses viz. MRR, TWR and Ra of Wet EDM, Dry EDM and ND-EDM were studied.

NOMENCLATURE

N	Tool Rotating Speed (rpm)
MRR	Material Removal Rate (mm^3/min)
TWR	Tool Wear Rate (mm^3/min)
Ra	Arithmetical mean surface roughness (µm)

II. Experimental Setup

The experiment was investigated using Savita ZNC EDM having tool rotating attachments. An air compressor is used to supply compressed air between the electrodes gap for Dry EDM. The Near dry minimal quantity lubrication (MQL) device is used to develop two phase liquid and gas mixture for the ND-EDM. Experiment was conducted by using copper as electrode and EN31.