Potejanasak Potejana 2009: A Study of Optimum Polishing Condition for Rotary Tool Polishing Hardness Steel. Master of Engineering (Industrial Engineering), Major Field: Industrial Engineering, Department of Industrial Engineering. Thesis Advisor: Mr. Chana Raksiri, D.Eng. 156 pages.

This research proposes a new application of 3-axis CNC milling machine for polishing the 60 HRC hardness steels. The rotary polishing tools are designed by refer to the end-mill ball nose's design. The diamond powder are coated in rotary polishing tools by resinoid bonding method and concentrated in 4.4 karat/cm^2. The Zig-milling tool paths are used to polish the hardness steel. After polishing, the confocal laser scanning microscope is used to analyze the arithmetic mean surface roughness of the hardness steels. The L_{12} orthogonal array of the Taguchi's method is selected to conduct the matrix experiment to determine the optimal polishing process parameters. The diamond grit size and cutting speed of the rotary polishing tools, feed rate and step over of the tool path, the depth of polishing process penetration, and polishing time are used to study. The combination of the optimal level for each factor of the hardness steel polishing process are used to study again in the confirmation experiment.

Experimental results show that the combination of the optimal level for each factor of the polishing process are the diamond grit size of 40-60 μm, 450 m/min cutting speed of rotary polishing tools, 50 mm/min feed rate and 20 μm step over with Zig tool path, 120 μm depth of penetration, and the number of polishing of two replication. The predicted signal to noise ratio of smaller - the better under optimal condition are calculated by using the data from the experiment are 20.48 dB. The optimal parameters for hardness steel polishing are used for the confirmation experiment. The results of the confirmation experiment are 19.28 dB mean signal to noise ratio of smaller - the better, about 94.18% of the predicted signal to noise ratio of smaller - the better under optimal condition. The results show that, the mean surface roughness of hardness steel polishing process is improved by the diamond rotary tools with the 3-axis CNC milling machine.

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