INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Investigation of Anodic Dissolution Process to Overcome the Challenges during Micro-Manufacturing

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SHORT ABSTRACT

The present thesis focuses on solving the two major challenges of micro-manufacturing via the electrochemical-based method. The significant advantage of this method is high dimensional accuracy and better surface integrity. The thesis is divided into two sections. The first section includes the development of electrochemical micromachining (EMM) setup and the fabrication of microtools. The second section consists of developing an electropolishing (EP) setup and improving the surface integrity of electrical discharge machined components.

In the first section, an experimental setup of EMM has been designed and developed for the fabrication of micro-features. The developed setup consists of subsystems: the power supply unit, tool and workpiece holding unit, electrolyte and filtration unit, and the CNC controller for precise movement. EMM is also termed an anodic dissolution process, i.e., the terminal which acts as an anode (connected to the positive terminal of the power supply) will undergo atom-by-atom dissolution. The electrolyte container is made of Perspex material, a non-conductive and non-reactive material, so there is no charge loss during the process. One major hurdle in developing the EMM setup is to provide a power supply to the rotating tool. It is solved with the help of a carbon brush arrangement. A fixture is also developed for holding and supplying power to the workpiece. With the developed EMM setup, microholes are fabricated with the help of a microtool diameter of 500 µm. The fabricated microholes have an entry and exit diameter of 654 µm and 538 µm, respectively.

In the second section of the thesis, an experimental setup of electropolishing (EP) has been designed and developed for the surface integrity improvement study of the electrical discharge machined thin-cruciform gimbal flexure of the gyroscope. The material used for the fabrication of the gyroscope is maraging steel. An organic electrolytic combination of acetic acid and perchloric acid in the volume ratio of 3:1 is selected. A polarization curve is drawn to find the voltage-current characteristics of the selected electrolyte on the maraging steel workpiece.