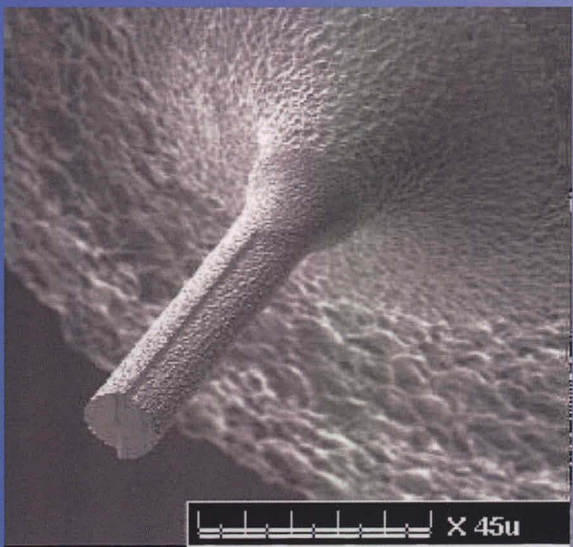
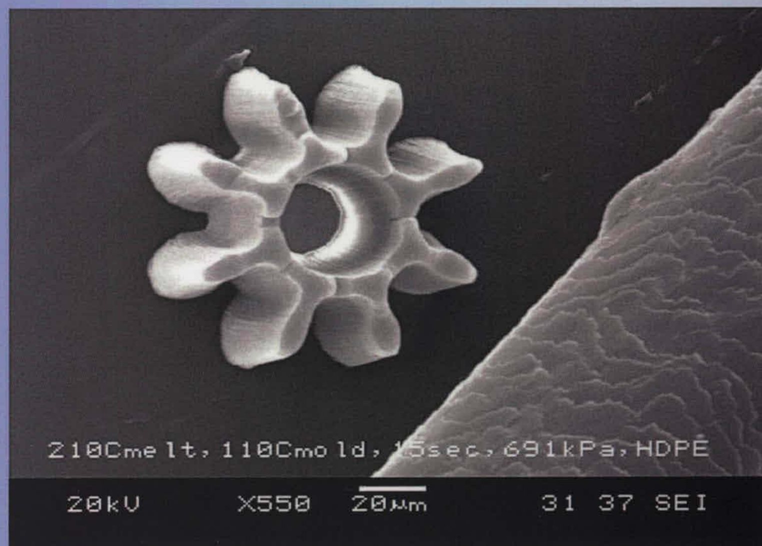
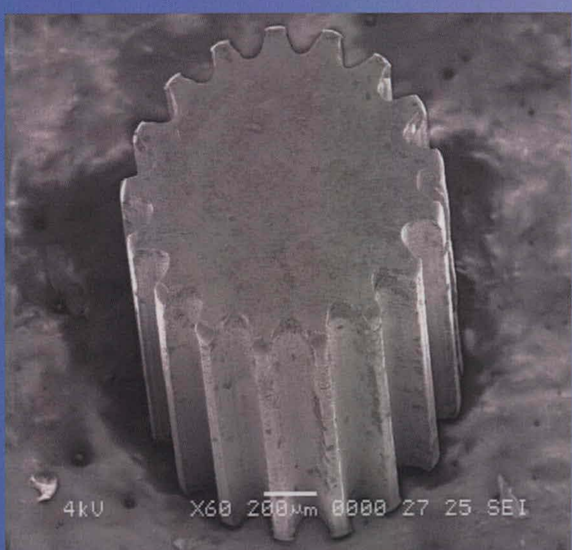
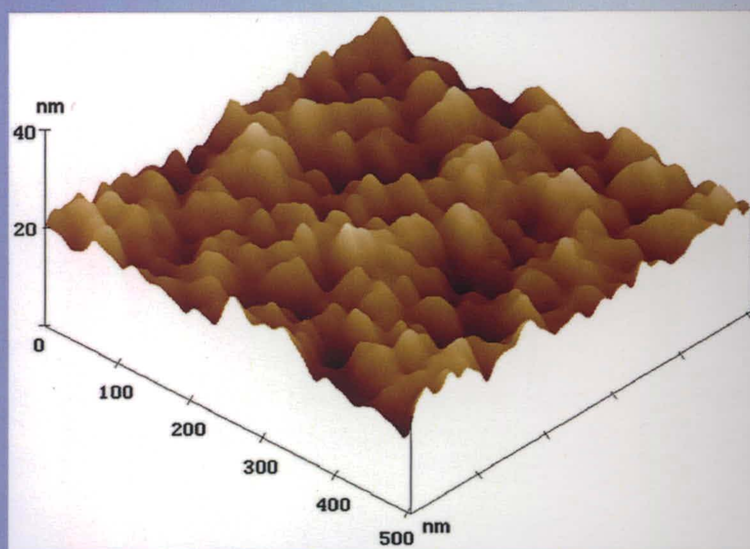
Advanced Machining Process









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Chapter 30

High Speed Milling of Mould Steel using 1.5mm-diameter End-mills

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Keywords: High speed milling, 1.5mm-diameter end-mill, S-Star steel, Mould steel, Chip thickness, RSM

Abstract. This project represents the experimental investigation of high speed milling of s-star steel for mold and die making. The experiments were performed by using carbide end mills and different parameters. The effects of the different machining parameters on the thickness of the chips produced and the surface integrity were investigated. The parameters involved are spindle speed in the range of 30000 rpm to 50000 rpm, depth of cut from 0.1 mm to 0.3 mm and feed rate from 6 mm/min to 10 mm/min. Box-Benkhen response surface methodology approach was employed for the design and analysis of the experimental results. Though the chips produced were mostly segmented, it has been observed from the experimental results that the lowest chip thickness was obtained at speed 50000 rpm, depth of cut 0.20mm and feed rate 6 mm/min.

Introduction

High speed milling (HSM) technology is one kind of emerging advanced manufacturing technologies (AMT), which results from the integrated application and development of many new technologies such as new material technology, computer technology, control technology, precision manufacturing and so on. HSM technology has more superiority than low speed milling greatly increasing the material cutting ratio per unit time, getting more smooth surface quality, successfully machining high rigidity materials [1]. Since the early 1990's, with the maturing of high speed numerical control machine tools and cutting tools techniques, HSM technique has increasingly become a successful key machining technique.

High speed machining has become a versatile application in industry fulfilling the requirements of high productivity and better quality. Its applications are widely mold and die making, in forging dies, casting dies, injection molds and blow molds as well as in modelling and prototyping of dies and molds. High geometrical accuracy, low cutting forces are among the advantages of high speed machining that finds applications mainly in aerospace and die and mould industry [2, 3]. Thus important applications of high speed milling include the manufacture of dies and molds.

In high speed milling, hard material like high-alloy tool steels up to 60-63 HRC can be machined. The work-piece material H13 tool steel, heat treated to 45 and 55 HRC [4] has been milled. The suggested cutting speeds for milling these materials lie between 500 to 1000 m/min [5, 6].

Milling is an intermittent cutting process performed by a multi point cutting tool, where the chip formation process is more complex compared to turning operation that has a continuous cutting action. High speed milling can be, milling at higher speeds or higher feed