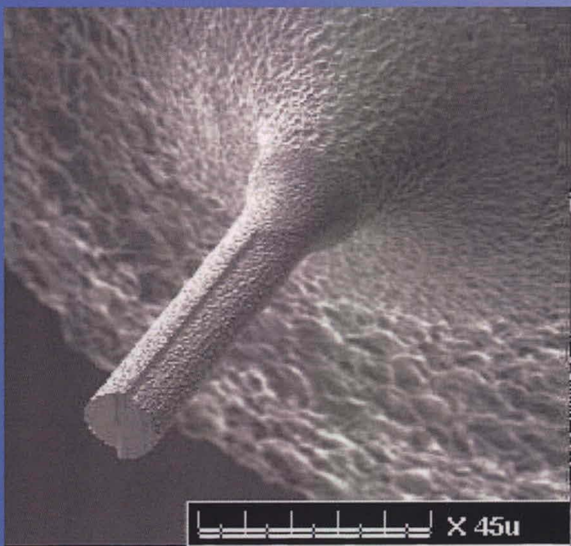
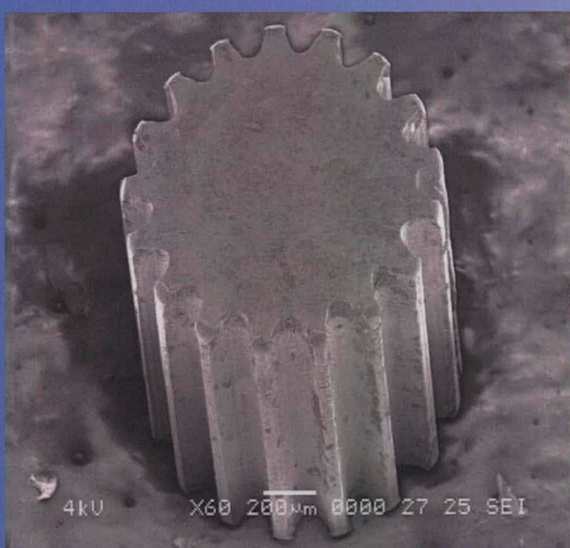
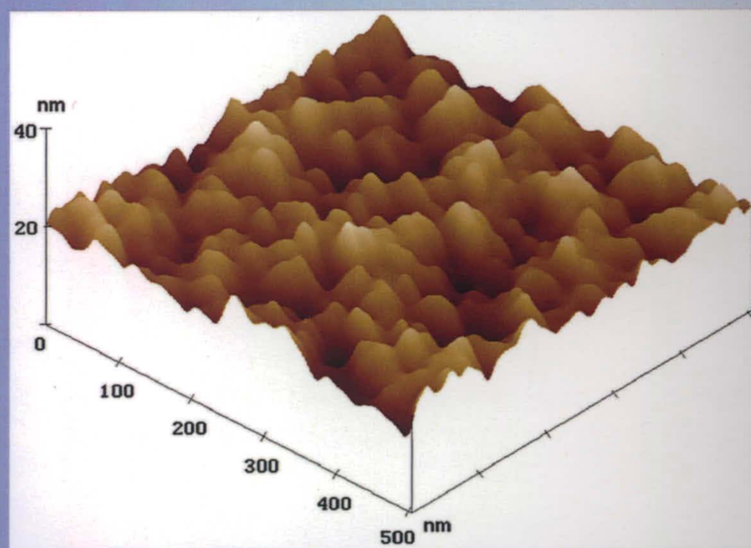
Advanced Machining Process







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Chapter 35

A Comparative Study on Flank Wear and Work Surface Finish during High Speed Milling of Cast Iron with Different Carbide Tools

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Keywords: High speed machining, Flank wear, Carbide, Work surface finish

Abstract. Tool life sharply reduced for all the carbide tools while increasing cutting speed twice (from 500m/min to 1000m/min) during machining cast iron. Though the productivity would be double at the speed of 1000m/min than that at the speed of 500m/min, tool wear increases to a few times which indicates that the inserts used are not suitable for machining at a high speed like 1000m/min. It is better to cut cast iron using uncoated K20 carbide at low cutting speed rather than at high speed. TiAlN coated carbide has the best wear resistance at both speeds.

Introduction

High speed machining is a relative term from machining viewpoint because of the vastly different speeds at which different materials can be machined with acceptable tool life. It is generally preferable to define machining speeds quantitatively in terms of specific ranges. It has been classified that 600 to 1800 m/min should be termed as high speed machining, 1800 to 18000m/min as very high speed machining and greater than 18000m/min as ultrahigh-speed machining [1].

To perform high-speed machining, four focus areas must be addressed: processing, programming, machine system and cutting environment. A precise analysis of factors such as work material and cutting tool materials characteristics, tool life, allowable tolerances and the process characteristics of the machine itself is needed before setting up the job.

Cemented carbides are comprised of one or more carbide compounds bonded in a metallic matrix. The common cemented carbides are based on Tungsten Carbide (WC), Titanium Carbide (TiC) and Chromium Carbide (Cr_3C_2). Tantalum Carbide (TaC) and others are commonly used. The principal metallic binders are cobalt and nickel. Cobalt is the binder used for Tungsten Carbide (WC) and nickel is the common binder for Titanium Carbide (TiC) and Chromium Carbide (Cr_3C_2). Even though the binder constitutes only about 5% to15%, its effect on mechanical properties is significant in composite materials. Using WC-Co alloys as example, as the percentage of cobalt is increased hardness is decreased and transverse rupture strength (TRS) is increased. TRS correlates with toughness of the WC-Co composite. TiC-Ni is also used as a cutting tool material for machining steels.

The first generation of coated carbides had only a single layer coating (TiC, TiN or Al_2O_3) and this type of tool is still in use. More recent coated layers have been developed that consist of multiple layers. The first layer applied to the WC-Co alloy bar is usually TiN or TiCN due to its good adhesion and similar coefficient of thermal expansion. Additional layers of