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HIGH SPEED CUTTING

An Approach towards Improved Machining Performance



Manufacturing and Materials Department

Kulliyyah of Engineering
International Islamic University Malaysia

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Experimental Investigations in High-Speed Hard Turning of AISI 4340 Steel Using Mixed Ceramic

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7.1 Introduction

Hardened steel and other hard materials are machined by grinding process in general, but grinding are time consuming and limited to the range of geometries to be produced (Poulachon et al., 2004; Singh & Rao 2010). The best alternative for grinding is by hard turning. Hard turning has emerged since modern cutting tools such as ceramics were available to reduce the time needed to finish hardened parts those with hardness ranging from 45 to 70 HRC. The secret to successful hard turning is by higher cutting speed because hard turning processes are usually associated with high temperatures. At these speeds, heat goes out with the chip and not into the tool or the work piece, so the wet cutting becomes useless (Sharma, 2001).

The term high speed may not be the same for different materials, high speed for one material may be a low speed for another (for example, the high speed for titanium is a low speed for aluminum).

Another sign for the high speed is the chip shape. The chips produced under various cutting speeds have different shapes. At low cutting speeds the chip is a continuous type but when the speed is increased, it is changed to saw-tooth type (Lin et. al., 2008; Sharma, 2001).

For a better understanding of high speed hard turning (HSHT) it is necessary to look back cutting forces, surface roughness and flank wear progress. In this research the following parameters will be covered; cutting speed 175-400 m/min, feed rate 0.075 – 0.15 mm/rev, constant depth of cut 0.15 mm and negative rake angle from zero to (-12) degree. The work piece material was AISI 4340 hardened to 60 (HRC) and the cutting tool was mixed ceramics (AL₂O₃-TiC) under dry conditions.