

# Hard Turning of Crankshafts – Demo plan

by  
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## 1. Introduction

The machining of hardened steel components with PcBN inserts having a geometrically defined cutting edge has gained substantially in importance due to improvements in the performance of such modern cutting tool materials. Thus, hard turning is a finishing process that is gaining in importance in industry, as new tools having increased wear resistance, high temperature resistance, and toughness have been developed. Hard turning is increasingly a profitable alternative to finish grinding. The objective is to remove workpiece material in a single cut rather than a lengthy grinding operation, thus reducing processing time and production costs.

## 2. Schematic of the project

Surface finish is one of the most important and stringent requirements placed on finishing processes. In order to replace grinding by hard turning, the surface finish is one of the most critical issues when judging alternative processes. Tool wear is also a major concern in precision turning since surface finish generally degrades as the tool wears; in addition, form accuracy is lost unless wear compensation is used. These demonstrative cutting tests will focus on the surface roughness of the machined parts depending on the machining parameters.

## 3. Experimental set-up

The experiments will be carried out in the Micro-Machining Laboratory of the Precision Micro-Machining Center at the University of Toledo. A CNC lathe (Mori Seiki SL250) will be used as the test bed. The parts will be clamped using the machine's capabilities (chuck and tailstock). The material of crankshafts is RD CF 1117 steel. The hardness of the component parts is  $62 \pm 2$  HRC.

Concerning the tools, two types of inserts have been chosen for this project. One of them is AMBORITE DBC50 and the other one is AMBORITE DBN45. DBC50 is a low content, fine grain PcBN material on a tungsten carbide base. The CBN content is 50% by volume in a TiC binder phase, and the average CBN grain size is  $2\mu\text{m}$ . DBN45 is a low content PcBN material (45% - CBN) with a sub-micron grain size integrally bonded with a titanium nitride (TiN) ceramic binder onto a tungsten carbide base.

## 4. Description of the experiment

Different cutting regimes will be chosen and the average roughness will be measured using a Hommel profilometer. The envisaged values for the cutting parameters are the following:

Feed rate  $f = 0.0008$  in/rev,  $0.005$  in/rev, and  $0.0092$  in/rev

Cutting Speed  $v = 328$ ,  $410$ , and  $492$  sfm

Depth of cut  $a = 0.004$ ,  $0.007$ , and  $0.01$  in

These tests will be performed for each type of PcBN insert.

## 5. Conclusions

This demonstrative test will present the capabilities of PcBN inserts in case of hard turning as an alternative for grinding. The measurements will show also how suitable is a hard turning process for finishing hardened component parts made of steel. Finally, the influence of the PcBN insert type on machined surface roughness will be envisaged.

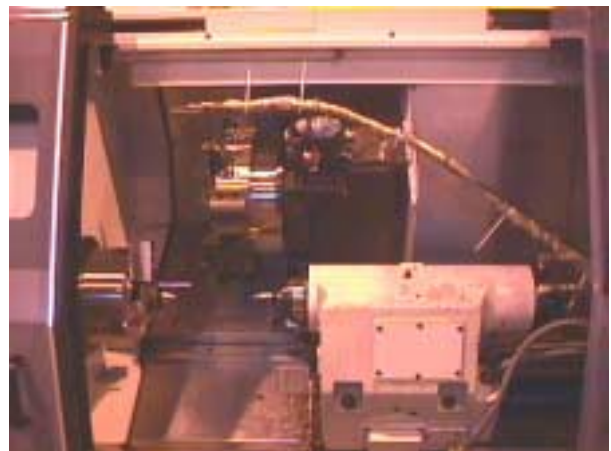


Figure 1. CNC lathe Mori Seiki SL 250

Figure 2. Photo of the working zone