

## Influence on temperature variation, tool-wear and tool-life with respect to cutting speed on diamond-coated WC–Co inserts in the machining of Al–15% SiC alloy

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**Abstract:** The study was undertaken to evaluate the cutting performance on Al–15%SiC alloy using diamond coated tungsten carbide (WC–Co) inserts. The nanocrystalline diamond (NCD) and microcrystalline diamond (MCD) coatings were deposited on WC–Co cutting inserts using predetermined process parameters in Hot Filament Chemical Vapour Deposition (HFCVD) with the architectures of WC–Co/NCD and WC–Co/MCD. Turning tests were carried out under varying cutting speed keeping other parameters constant within dry condition. Different cutting speeds of 315, 500, 775 and 1000 rpm were selected to study the effect on temperature variation, tool-wear and tool-life of WC–Co, WC–Co/NCD and WC–Co/MCD cutting inserts. In this work, Flank wear was the most dominant wear mode observed on diamond coated inserts. HRSEM images analysis of flank wear suggested that wear was possibly due to sliding between the cutting inserts and Al–15%SiC alloy that cause adhesive, abrasive and build-up-edge (BUE), acting singly or in combination. The diamond coated WC–Co inserts were observed to show lower temperature variation and minimum tool-wear compared with uncoated one due to a thin diamond coating thickness of  $\sim 3 \mu\text{m}$ , which reduces the cracking phenomenon occurred during turning process. Moreover, under same machining parameters the diamond coated inserts show enhancement in their tool life in comparison to conventional WC–Co insert.

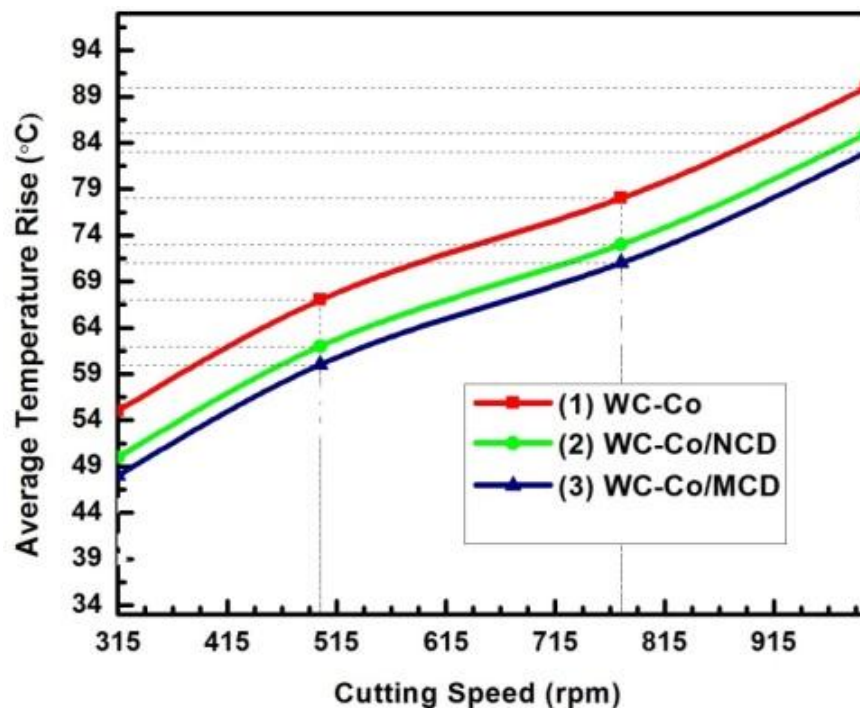


Figure (1): Temperature of tool edge vs. cutting speed.

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Table 1: Experimental input operating parameters for turning.

Parameters	Range
Feed	0.191 mm/rev
Depth of cut	0.2 mm/rev
Machining Time	15 min
Lathe Machine	Automatic Centre Lathe (CNC)
Power	10 kw
Maximum Cutting speed	315, 500, 775 & 1000 rpm
Feed range available	0.1– 0.5 mm/rev
Cutting Insert type	WC–Co (SPUN120308, 6%Co) & Diamond coated/WC-Co
Work piece type	Aluminum alloy (Al–15%SiC)
Tool holder	270 SCP 2525 75°

**Biography:** Kaleem Ahmad Najar has completed his PhD in mechanical engineering from NIT Srinagar, India in 2018 and was working on “Tribological and Mechanical Characteristics of CVD-diamond Coatings Deposited on Tungsten Carbide Cutting Tools”. His research work is based on Surface Science and Engineering Tribology and is now presently working as Assistant Professor in the same institute. Kaleem Ahmad Najar has ten international publications in reputed journals and his work is based on physical, mechanical, Tribological and machining properties of synthetic diamond coatings