



### **Science Arts & Métiers (SAM)**

is an open access repository that collects the work of Arts et Métiers Institute of Technology researchers and makes it freely available over the web where possible.

This is an author-deposited version published in: <https://sam.ensam.eu>  
Handle ID: [.http://hdl.handle.net/10985/10926](http://hdl.handle.net/10985/10926)

#### **To cite this version :**

Lamice DENGUIR, Aurélien BESNARD, Guillaume FROMENTIN, Gerard POULACHON, Xiaowen ZHU - Flank wear prediction in milling AISI 4140 based on cutting forces PCA for different cutting edge preparations - International Journal of Machining and Machinability of Materials - Vol. 18, n°3, p.273-287 - 2016

Any correspondence concerning this service should be sent to the repository

Administrator : [scienceouverte@ensam.eu](mailto:scienceouverte@ensam.eu)



---

## **Flank wear prediction in milling AISI 4140 based on cutting forces PCA for different cutting edge preparations**

---

**L.A. Denguir\***

Arts et Metiers ParisTech, LaBoMaP,  
Rue Porte de Paris, 71250 Cluny, France  
and

Ecole Nationale d'Ingenieurs de Monastir, LGM,  
avenue Ibn El Jazzar, 5019 Monastir, Tunisie  
Fax: +33-3-8559-5370

Email: Lamice.DENGUIR@ensam.eu

\*Corresponding author

**A. Besnard, G. Fromentin and G. Poulachon**

Arts et Metiers ParisTech, LaBoMaP,  
Rue Porte de Paris, 71250 Cluny, France

Email: Aurelien.BESNARD@ensam.eu

Email: Guillaume.FROMENTIN@ensam.eu

Email: Gerard.POULACHON@ensam.eu

**X. Zhu**

Arts et Metiers ParisTech, LaBoMaP,  
Rue Porte de Paris, 71250 Cluny, France  
and

Shanghai Jiao Tong University,  
Dong Chuan Lu Minhang, 200240 Shanghai, China  
Email: eversince@aliyun.com

**Abstract:** One of the criteria mastering the choice of a cutting tool is its wear resistance. For coated inserts, prior to the coating process, edge preparation method choice will impact their performance. So, a classification based on its impact on wear resistance is needed. Indeed, the flank wear of three coated cemented carbide inserts presenting differently prepared edges (untreated, dragging and magneto-abrasive machining) is explored experimentally. Those inserts are used to face mill the hardened AISI 4140 low alloy steel. Further, by means of the principal component analysis (PCA), correlations between the online measured cutting forces and flank wear behaviour are investigated. In view of this analysis, for each studied case, the statistical law predicting flank wear relying on cutting forces components is established with fair approximation. However, the experimental results have quantitatively shown that edge preparation could be in some cases not beneficial for tool wear resistance of the milling inserts considering either maximal or average flank wear.