Chapter 9

Inventory of Experimental Works on Cutting Tools’ Life for the Wood Industry

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ABSTRACT

Woodworking is based on a trinomial machine/piece/tool. For maximum quality of the manufactured piece, it is important not to separate this trinomial, but the limited life of tools prevents that permanent contact. This phenomenon is due to the wear of the cutting parts of the tools. The prevention of wear is based on two methods. The first is to anticipate the end point of tool wear, changing these after a fixed period, no matter what. The other school is to recognize the tool wear at the event: the tools are changed once they are really worn out, finding faults on manufactured parts. A worn tool generates pieces with non-compliant quality or even unusable. A deeper understanding of wear and its consequences would change the tool at the right time. The tool wear for wood is due to several phenomena interacting with each other. The first dominating phenomenon is a corrosive attack that decreases the mechanical strength of the surface. The second is an abrasive attack whose work is facilitated by the reduced resistance of the surface. Repeated shocks can be in the degradation of the cutting edge, temperature acting as amplifier to wear. Understanding of the wear patterns can characterize the life of tools by wear measurement to find ways to extend this period with development of tool coatings, while maintaining optimal conditions for woodworking to get the best finish.

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INTRODUCTION

For wood machining in industry, the tool choice is made generally considering its linear and angular values, according to the specific task that it must develop, but without taking into account the cutting material quality. The tool performance is related to cutting kinematics and chip formation process, requiring a certain cutting energy to develop its work, and affecting then the tool material, expressed as cutting edge recession, and consequently affecting the product final quality. Indeed, this cutting edge recession or tool wear is a phenomenon roughly managed at the wood industry, where the tool life limits are unknown then not improving the tool performance neither the work piece quality nor manufacturing costs.

The aim of this chapter is to make initially an analysis and to understand the impact of physical, chemical and mechanical phenomena on tool wear for different cutting materials. Then, the presentation of different methods of wear’s evaluation permits us to characterize importance of parameters on the evolution of wear, such as angles, surface quality of cutting materials, wood species, cutting temperature and cutting power. Different solutions are utilized in the goal of increasing tool’s life: cutting material, surface treatment, tools coating. Finally, the ameliorations of cutting material don’t forget us the good choice of cutting conditions, prerequisite for tools’ long life.

What happens in future? For wood development, since a few years, there are a lot of researches made on various aspects: understanding of wear phenomena, solutions for wear measurement and development of tools coatings. The researchers want to develop another choice than diamond tools.

MECHANISMS OF DAMAGE OF CUTTING TOOLS

Chemical Wear

Wear chemical may occur in four forms:

- **Oxidation**: Reserved for mechanisms of high-temperature corrosion by hot gas. This type of corrosion leads to the formation of dry oxide layer.
- **Electrochemical Corrosion**: It occurs in the aqueous phase by the formation of a stack between oxidant (O2 or H2O) and metal. An electric current flow between anodes and cathodes; then, anodes are attacked.
- **Biochemical Corrosion**: Due to the activity of bacteria on the surface of metals. The mechanism of this specific corrosion is of several types:
Square-Cup Deep Drawing of Relatively Thick Sheet Metals through a Conical Die without Blankholder
International Journal of Materials Forming and Machining Processes (pp. 31-46).
www.igi-global.com/article/square-cup-deep-drawing-of-relatively-thick-sheet-metals-through-a-conical-die-without-blankholder/130697?camid=4v1a