Indirect Adhesion Wear Parametric Analysis in the Dry Turning of UNS A97075 Alloys

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1. Introduction

Aluminum wrought alloys (mainly 2000 and 7000 series) are widely used in the manufacturing of structural parts of aircraft, where the requirements in high compressive strength, tension loading or fatigue are critical [1]. These parts are usually manufactured using machining processes. In addition, the actual trend is using environmentally friendly technologies, such as dry machining. Notwithstanding, these cutting conditions cause an increase of tool indirect adhesion wear, which may result in deviations from the quality requirements [2-3].

In this work a study of the influence of cutting parameters (cutting speed, feed and depth of cut) on indirect adhesion tool wear in the dry machining of UNS A97075 Al-Zn alloys has been made. In addition, an experimental methodology for the measurement of Built-Up-Layer on the tool has been developed. Finally, different parametric models have been obtained, which allow predicting the BUL evolution as a function of cutting parameters applied.

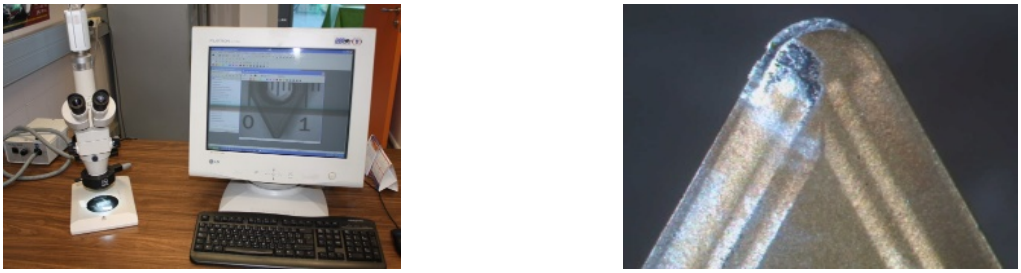
2. Methodology or Experimental Procedure

Different turning test were performed using cylindrical bars of UNS A97075 (Al-Zn) Alloy, in dry conditions. For each test a new tool (WC-TiN) was used. The cutting parameters values tested are shown in Table I. All test lasted 10 s.

Table I. *Cutting parameters*

v_c (m/min)	f (mm/r)	a_p (mm)
40	0.05	0.5
80	0.10	1.0
170	0.20	2.0
200	0.30	

The rake face of the tools was off-line monitored by using Stereoscopic Optical Microscopy (SOM) techniques, Figure I. In addition, a first approach to the measurement of the quantity of material adhered on the tool rake face was performed by using images analysis techniques.



(a) (b)

Figure 1. *(a) SOM equipment setup and (b) SOM image of tool tested.*

3. Results and Discussion

For all test performed, an indirect adhesion wear can be observed both on the rake face (BUL) and the edge of the tool (BUE). The variable which most influences on the intensity of this wear is the feed. The second one is the depth of cut and, finally, the cutting speed is the least influential variable. So, different parametric potential models have been developed (BUL intensity = f(v_c, f, a_p)). In addition, these experimental results have been compared with those obtained for different output variables, such as arithmetic average roughness (*Ra*) of machined parts.

4. Conclusions

In this work, an experimental methodology for BUL measurement in the dry turning of UNS A97075 (Al-Zn) Alloy has been developed. As a result, a parametric model which allows predicting the BUL intensity as a function of the cutting parameters has been obtained.

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6. References

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