Manufacture of an abrasive jet machining (AJM) equipment adapted for the treatment of rotary flexion fatigue specimens

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1. Introduction

The surface topography influence on several physic-chemical surfaces and mechanical properties, such as the fatigue behaviour, corrosion resistance and micro-hardness, is widely accepted, even though their basic principles are unknown [1]. Machining processes results in several surface alterations, both at micro and macro-geometrical scale, being directly influenced by the cutting parameters (feed, cutting speed and cutting depth) [2]. The actual trends of light alloys machining is suppressing the use of cutting fluids in the manufacturing of structural parts of aircraft. Under these conditions, surface alterations become higher in comparison with the use of cutting fluids. In this context, a study of the cutting parameters influence on surface integrity of light alloys machined parts is being developed by the authors [3]. In order to carry out this research, different specimens of light alloys are being tested, to be used in standard test of several mechanical and geometrical properties. These results, obtained by main machining processes, have been compared to those obtained by applying an additional finishing operation, as Abrasive Jet Machining (AJM) [4]. Since there was not available, an AJM equipment has been designed, manufactured and tested.

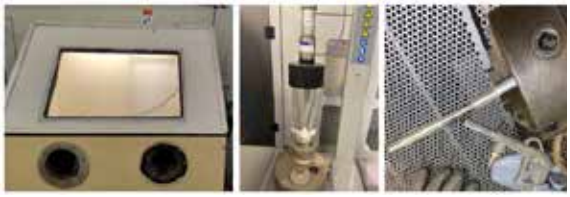
In this work, the different steps and experimental methodology used is exposed.

2. Methodology and results

The elements that compose the AJM equipment were the following (Figure 1): gas supply system, gas filter, water separator, powder supply and mixer, hand holder, nozzle, dust exhausting unit and security chamber. For the nozzle positioning, a holder with positioning equipment and an automated rotary table have been provided to characterize the attack angle where the specimen rests.

A system with similar characteristics have a cost close to 5000 €, being necessary its adaptation (a fixture for the test specimen have to be added).

However, the AJM made *ad hoc* had a cost of 548 €, divided in: labour 180 € and materials 368 €.



a *b* *c*

Figure 1. AJM machine: a. Security chamber; b. powder supply and mixer; c. Rotatory system and nozzle.

Additionally, a setup of the equipment was carried out. The surface roughness of different specimens has been compared by using different abrasive material. Finally, the first results of the comparative analysis between specimens, with and without applying AJM, are shown.

3. Conclusions

In this work, an Abrasive Jet Machining was designed, manufactured and tested, resulting in a 85% savings in comparison with a commercial machine.

This equipment has allowed starting the research to complete the influence of surface integrity on light alloys machined parts.

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5. References

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