THEORETICAL AND EXPERIMENTAL CONTRIBUTIONS REGARDING THE SURFACE QUALITY OBTAINED BY HIBRID PROCESSING USING MILING AND PLASTIC DEFORMING ON THE MAGNESIUM ALLOY AZ31B-F

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Combined manufacturing processes like cutting and burnishing (turning-burnishing, milling-burnishing and skiving) represent a current and future method of processing. By applying this hybrid cutting-burnishing process the fallowing improvements can be obtained: lower surface roughness, superior physical, mechanical and chemical properties and reducing the processing time by removing subsequent cutting processes (heat treatment, grinding or superfinishing). Using the milling-burnishing method at an industrial scale it possible only as a successive process (processing by milling fallowed by cold plastic deforming -burnishing-) and can be problematic because of the implementation of a high pressure hydraulic system in a modern machinery.

This thesis has aims to highlight the theoretical and experimental research with reference to processing magnesium alloys AZ31B-F by milling-burnishing, using successive and simultaneous process. The process parameters analyzed are the following: cutting speed, feed per tooth, cutting depth, burnishing pressure, burnishing pressure, type of process (simultaneous or successive) and the cutting direction (conventional or climb milling). The results refer to the analysis the of the surface roughness and material hardness obtained after milling and after milling-burnishing process, the depth of the deformed surface, subsurface layers microstructure, chemical composition and residual stresses.

The thesis is divided into seven chapters, in which the fallowing are presented:

- In the ***1st chapter*** are presented the result of the current state of the research regarding the cutting-burnishing process. In this first chapter are presented the type of processes and tools that can be used, the process parameters, general aspects regarding magnesium alloys, field of use, machinability and the drawn conclusions.
- Based on the conclusions from the ***1st chapter***, in the ***2nd chapter*** are presented the thesis objectives and the research methodology.
- In the ***3rd chapter*** is presented the experimental analysis of the influence of the milling-burnishing process parameters on the surface roughness and the depth of the deformed surface. The processing was made using the simultaneous and successive processes, in both conventional and climb milling conditions. The results were analyzed with respect to each process parameter.
- In the ***4th chapter*** is presented the experimental analysis of the influence of the simultaneous and successive milling-burnishing process parameters on the physical, mechanical and chemical properties. The material hardness, subsurface microstructure, chemical composition and residual stresses were analyzed.
- The ***5th chapter*** presents the theoretical analysis of the effects produced by the process parameter on the surface roughness, depth of the deformed surface and material

hardness. There were generated mathematical models, dependency graphs and the optimal values were determined, using the Surface Response method. Also there were highlighted the ties between the surface roughness and material hardness obtained after the milling process and those obtained after the milling-burnishing processes.

- The milling-burnishing process time, burnishing rate and productivity are presented in the ***6th chapter***. There were highlighted the connection between: the depth and width of the deformed surface, the process time and surface roughness, material hardness and depth of the deformed surface.
- In the ***final chapter*** are presented the general conclusions, the original contributions and future directions of research with respect to the simultaneous and successive milling-burnishing process.