

The main objective of the project is to examine the progression of the chip formation process as well as the temperature reached by cutting tool and workpiece material during precision milling of selected magnesium alloys. Magnesium alloys constitute a construction materials group with very good machinability, nevertheless their processing is associated with certain risk due to their self-ignition tendencies. Especially prone to this phenomenon is magnesium dust, therefore it is necessary to decrease the use of abrasive machining to the essential minimum. High precision and quality of the elements manufactured from magnesium alloys must therefore be achieved by another machining methods. Precision milling seems to be the solution to achieve these objectives. Although precision machining has been known for a long time, its application to the machining of magnesium alloys is negligible. It is therefore necessary to better understand this process and the phenomena occurring during its implementation. The proposed project is focused on the analysis of the material removal process and further transformation of material into chips. Determining the machining conditions under which the cutting process is initiated is an important aspect of precision machining processes, as it enables the elimination of the ploughing phenomenon, which significantly decreases the quality of the formed surfaces. The author intends also to focus on determining the influence of individual technological parameters of the milling process and the type of cutting tool on the temperature reached in the cutting zone. Conducting such experimental investigations will contribute to the knowledge of phenomena concerning heat generated in the cutting zone during the precision milling process of magnesium alloys.

The experimental research will consist of magnesium alloys milling tests in the condition of precision machining. AZ91D and AZ31 magnesium alloys were selected for the study. The milling process will be performed on a milling centre. Two cutting tools characterised by a high sharpness, and are made of materials dedicated to magnesium alloys machining will be used in the study. During the milling tests, a high-speed camera will be used to record the material removal process as well as its transformation into chips, while a high-speed thermal imaging camera will measure the temperature in the cutting zone.

To date, there have been only a few publications on precision milling of magnesium alloys, and none of them concern the material removal processes and temperature measurements. The research conducted within the project will enable an analysis of material removal and chip formation processes, which are particularly important in precision machining. This will enable a more detailed understanding the precision machining process and its further development. Determination of machining conditions under which the cutting process is initiated, is an important aspect of manufacturing processes, enabling elimination of the ploughing phenomenon. Research will also be conducted on the temperature reached in the cutting zone. Determining the impact of individual variable factors on the generated temperature will enable the reduction of the amount of heat released. This is mainly due to the necessity of limiting the thermal expansion phenomenon of the cutting tool and workpiece material, which negatively affects the dimensional accuracy of the manufactured components, very important in precision machining. Effects obtained by a result of the proposed project will contribute to the development of the necessary knowledge on the execution of precision machining of magnesium alloys.