SLIDING CORE MANUFACTURING USING EDM TECHNOLOGY

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Abstract: An electrical discharge machining method for a toothed part is presented in this paper. The toothed part has to be manufactured by this method because of the complex shape of the teeth and because of their small dimension. The teeth are displayed over a defined curve and the front side of the part, where teethes are, is under a 1˚ angle from the main surface. The part is a sliding core from a plastic injection mould.

1. PRINCIPLE OF EDM

Electrical discharge machining (or EDM) is a machining method primarily used for hard metals or those that would be impossible to machine with traditional techniques. EDM only works with materials that are electrically conductive and can cut small or odd-shaped angles, intricate contours or cavities in pre-hardened steel without the need for heat treatment to soften and re-harden them as well as exotic metals such as titanium, kovar, carbide etc.

EDM is a nontraditional method of removing material by a series of rapidly recurring electric arcing discharges between an electrode (the cutting tool) and the workpiece, in the presence of an energetic electric field.

There are two electric discharge machines for EDM: with wire (WIRE cutting) and with massive electrode (DIE SINKING).

The electric discharge machines with massive electrode reproduce in the metallic workpiece the geometric shape of the cutting tool, namely the electrode.

The mode of action depends on the chosen technology. Most used are equimode and spirale. The electrode geometrical shape is identical with the one of the part that will be obtained. The electrodes are made basicaly from copper and grafite. Between the electrode and the piece there is never mechanical touch. During manufacturing, the workpiece is fixed on the machine table and the electrode is moving around the four axes: X, Y, Z and C (which is a round movment around its axis).

The common pieces, which are made using EDM technology, are plastic injection mould and its components (cores, sliding cores etc) or every other part that cannot be manufactured with classical technologies.

The scheme of the EDM with massive electrode on electric discharge machine procedure is shown in figure 1.

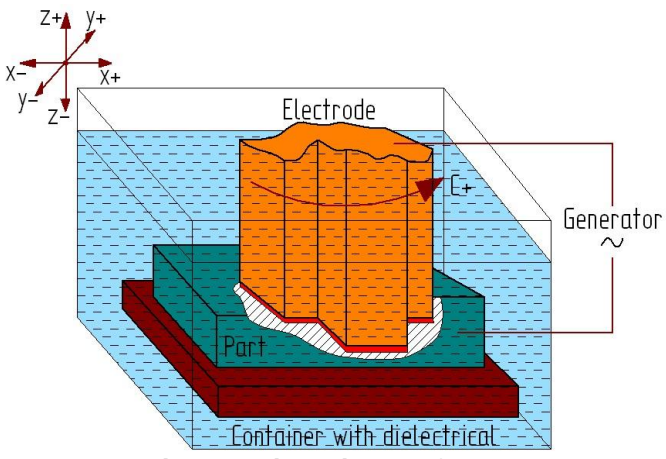

Figure 1 The scheme of EDM

2. EDM OF SLIDING CORE PART

The part is a sliding core from a plastic injection mould that had to be re-manufactured because of its great wear.

All of the manufacturing operations were made on the CNC machines, except the front side that has a toothed part at a 1˚ angle from the main surface, which had to be made using EDM.

The part, as it was projected in ProEngineer software, looks just like in figure 2.

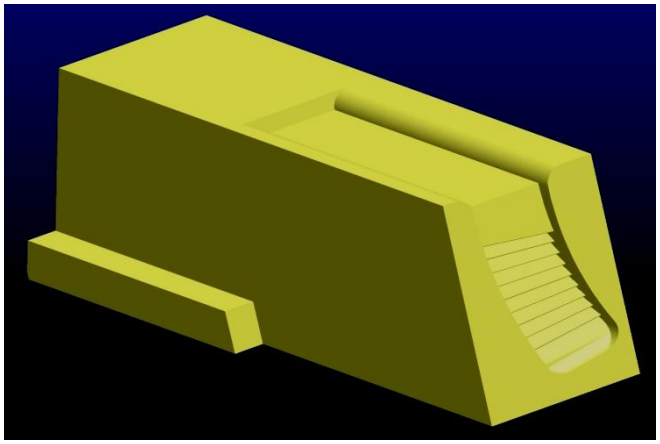

Figure 2 The sliding core part

Analyzing the surface that requires EDM operations, we discovered that the EDM should be made in two steps:

1st step – a rough phase
2nd step – a finish phase

For the rough phase it was considered a 0.4 mm GAP for the cooper electrode which processes the sliding core part. For the finish operations it was considered a 0.2 mm GAP.
For those two operations it was considered two cooper electrodes with the GAP as it were projected, a picture of an electrode with 0.4 mm GAP being shown in figure 3. It is important to consider the final part dimension in designing the electrodes due to the fact that the finish electrode will give the final dimensions of the piece.

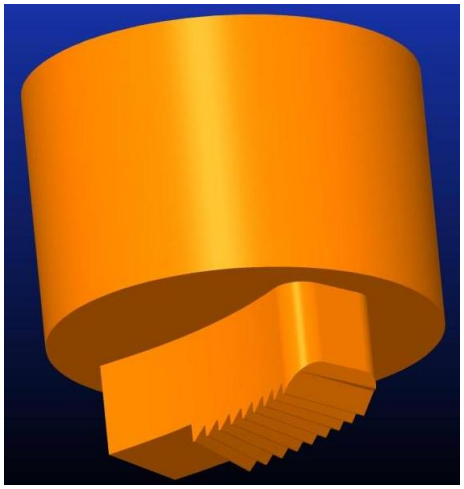

Figure 3 The electrode with the 0.4 mm GAP

The chosen technology for the EDM for the part was equimode, the machine for manufacturing being Charmilles Roboform 20. EDM manufacturing of the workpiece was made with the part fixed on the jaw vice on the machine table, as in figure 4.

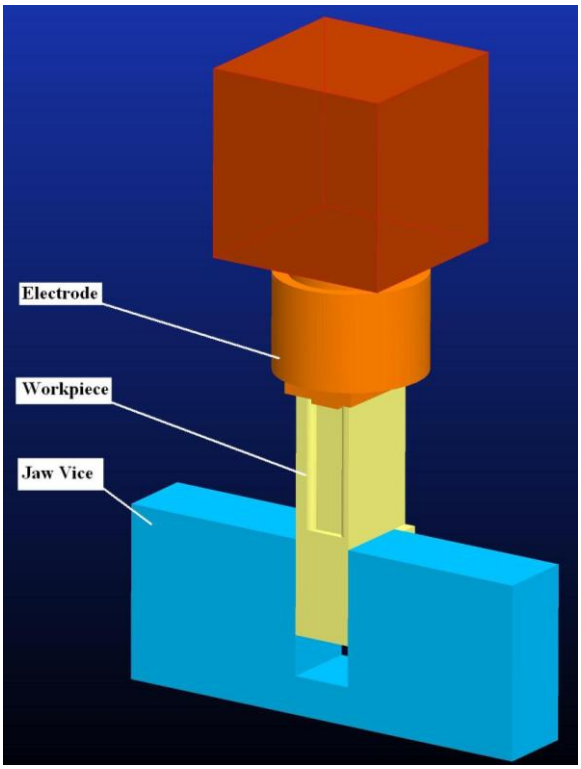

Figure 4 Scheme of the sliding core part EDM

A detail which simulates the electrode that approaches the workpiece, is shown in figure 5. This detail reproduces the exact movement of the real electrode as we manufactured at the place where the part was made.

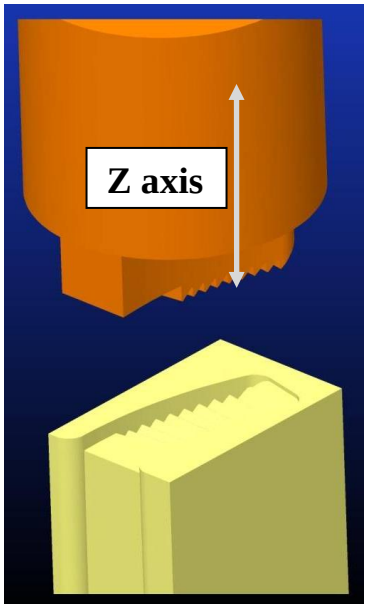

Figure 5 Detail of EDM for the sliding core part

The final part can be observed in figure 6, a after all the operations were done and in figure 6, b the initial wear part. In initial part it can be seen the wear at the toothed side part which produce many disadvantages to the plastic injected part.

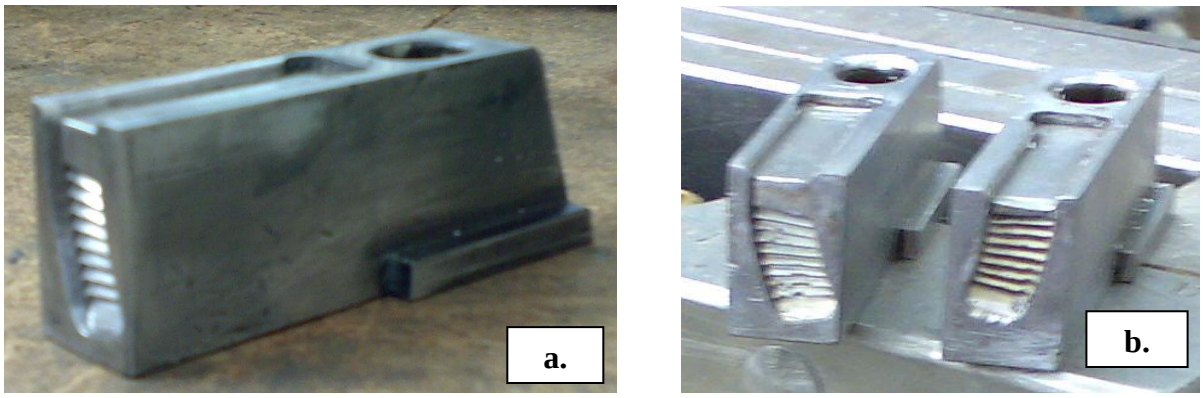

Figure 6 Sliding core part

3. FINAL CONSIDERATIONS

Using the die sinking method (EDM with massive electrode) for complex cavities manufacturing in steel blocks was required due to its high capacity in realization dimensional accuracy and for obtaining more and more complex shape for plastic injection mould and its components but not only.

The previous presented part requires an EDM because of its shape which cannot be processed with classical methods. The toothed part, with small teeth (aprox. 1 mm), arranged over a curve and with a slope surface to a 1˚ angle would be processed on EDM over the Charmilles Roboform 20 machine. The part is fixed on the machine table by the help of a jaw vice and the electrode is doing the z axis movement. The working program for the EDM machine was write on the design office and it was send to the machine in the working hall, the program being transferred into the machine equipment directly from the PC.

It is not quite a simple method because, for attaining the goal, that presume more technical operations to be made. First it was necessary to design the electrode that will manufacture the sliding core. The next operation requested a manufacturing post process for the machine tool to realize the electrode physically. Then, with the cooper electrode done, the EDM operation for obtaining the sliding core part can start.

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