USAGE OF CAD/CAM SYSTEMS IN DESIGN AND REALIZATION OF THE ELECTRODES USED FOR THERMOPLASTIC MATERIALS INJECTION MOULD PROCESSING, BY MEANS OF MODULAR DEVICES

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Abstract: this paper presents the realization principles of the electrodes used for thermoplastic materials injection moulds processing, using CAD/CAM systems. There is shown an application concerning design and processing of the electrode for the “Auto Tubes Support” part, by using the EUCLID software. The processing of the electrodes has been carried out by means of the modular devices according to the author’s original conceptions.

1. INTRODUCTION

The dimensions and precision of the tool-electrodes are very important at realization of thermoplastic materials injection moulds, because the precision of the mould active parts and, subsequently, the precision of the injected parts depend on these. Correct design and realization assure the accurate final dimensions of the injected part, taking into account the required additions for super-finishing and polishing of the mould active parts, along with the linear contraction of the injected thermoplastic material.

This paper shows an application concerning the execution of an electrode for the “Auto piping support” part, using the modular devices shown in [2] and [3]. Because the length of the tool-electrode cannot compensate its wear in the making of thermoplastic materials moulds, the cavities are brought to their final shapes by means of sets of tool-electrodes specially designed for coarse grinding, pre-finishing and finishing. Due to the fact that these electrodes have intricate shapes and according to the number of the mould active parts, the electrodes can be worked on numeric commanded centers by means of the above-mentioned modular devices, in which 1 ÷ 4 coarse grinding, pre-finishing and finishing electrodes can be simultaneously made.

2. THE BLOCK-DIAGRAM OF THE ELECTRODES REALIZATION

Fig.1 shows the schematic diagram for realizing the electrodes required for “Auto piping support” part, using CAD-CAM systems. After the 3D electrode model is made in the CAM module, the computer-assisted design of the technological processing (CAM) will be performed. In this case, the CAM module of EUCLID was used. The computer-assisted design of the technology is made in several steps and, where necessary, previous steps may be re-accessed for optimization. The steps to be followed in the design of the technology are presented as follows:

1. According to the 3D model of the finishing electrode and the processing additions, the 3D model of the coarse-grinding electrode is made. The following steps will be performed for both coarse-grinding and finishing electrodes.
2. According to the electrode material, the chipping additions and the required roughness, the electrode chipping operating conditions are computed.
3. The CAM module is fitted with databases about the characteristics of the available machines and chipping tools that may be automatically chosen, according to the

computed chipping operating conditions and the 3D electrode models previously realized.

4. The design of the tools required for the processing is a very important step, carried out also by means of a CAM module. This step is greatly simplified when using modular devices, because these can be automatically chosen from the database according to the electrode grip section, instead of designing them.
5. According to the information gathered in the previous steps, the CAM module automatically generates the tool trajectory and the electrode-processing program; the main program is made in generalized ISO language. In order to run this program on the CNC machine, post-processing must be performed, which introduces in the part-program the features of the chosen CNC machine. Computer simulation is performed for program error detection and optimization of the chipping process and tool trajectory. After simulation, the program is adjusted and sent to the CNC machine memory.
6. Finally, the processing is carried out according to the program generated by the CAM system.

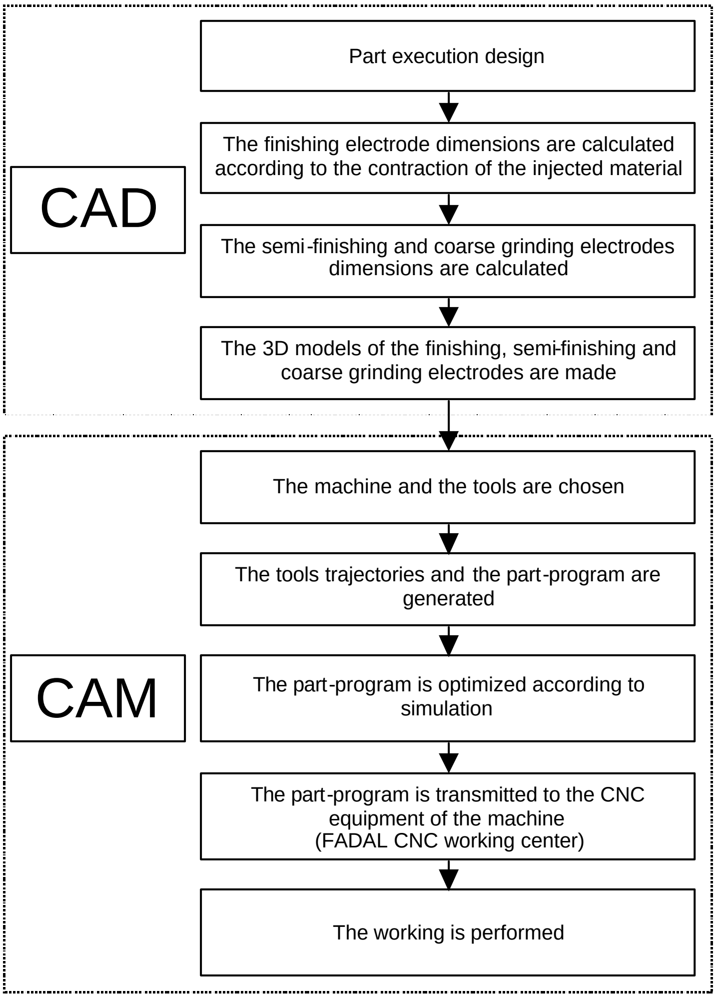

Fig.1. Schematic diagram of electrodes realization.

3. CONTRIBUTIONS CONCERNING THE USAGE OF MODULAR DEVICES IN ELECTRODES PROCESSING

In order to demonstrate the utility of the modular devices designed and realized by the author [2], [3], an application was made about the fabrication technology of the “Auto piping support” part, shown in fig.2.

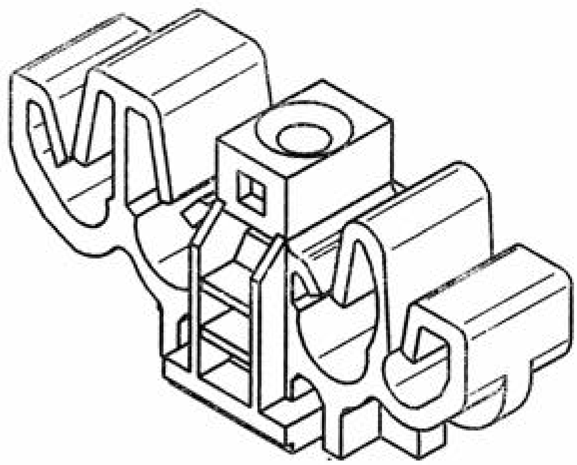

Fig.2 Auto piping support.

According to the design of the mould active parts, the electrode is designed taking into account the electrode material and the injected material – in our case PA66, which features a 2% contraction coefficient after injection. Because of the part intricate configuration and the wall slimness, graphite ELLOR+25 will be used for making of the electrode; its features are: 1.82 g/cm^3, density, 8% porosity, 58 MPa breaking strength, 1400 μO?cm resistivity, 10 μm granulation; fig.3 shows the structure of the chosen graphite [4].

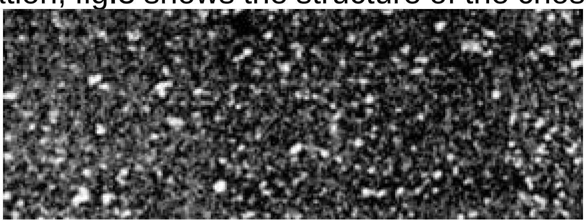

Fig.3. ELLOR+25 graphite structure.

The number of the mould active parts, the precision of the part to be made and the surface quality are to be taken into account when the number of electrodes will be chosen. In our case, the mould has four active parts, for which minimum eight coarse-grinding electrodes, eight semi-finishing electrodes and eight finishing electrodes are required. The processing will be carried out on a numeric command center FADAL VMC2216. Previously, the electrode coarse-grinding and finishing programs were generated in EUCLID3 [5].

Fig.4 shows the four elements modular device, mounted on the processing table of the FADAL CNC. First, the coarse-grinding program is run, during which the machine is fitted with a Ø6 mm mill (fig.5).

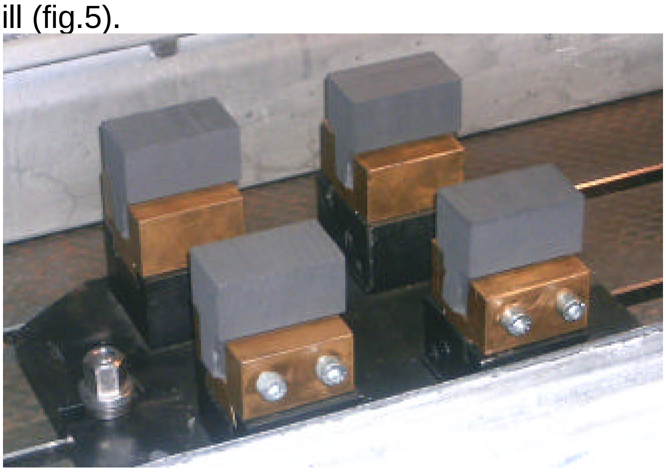

Fig.4. Four elements modular device, on the processing table of FADAL VMC2216 machine.

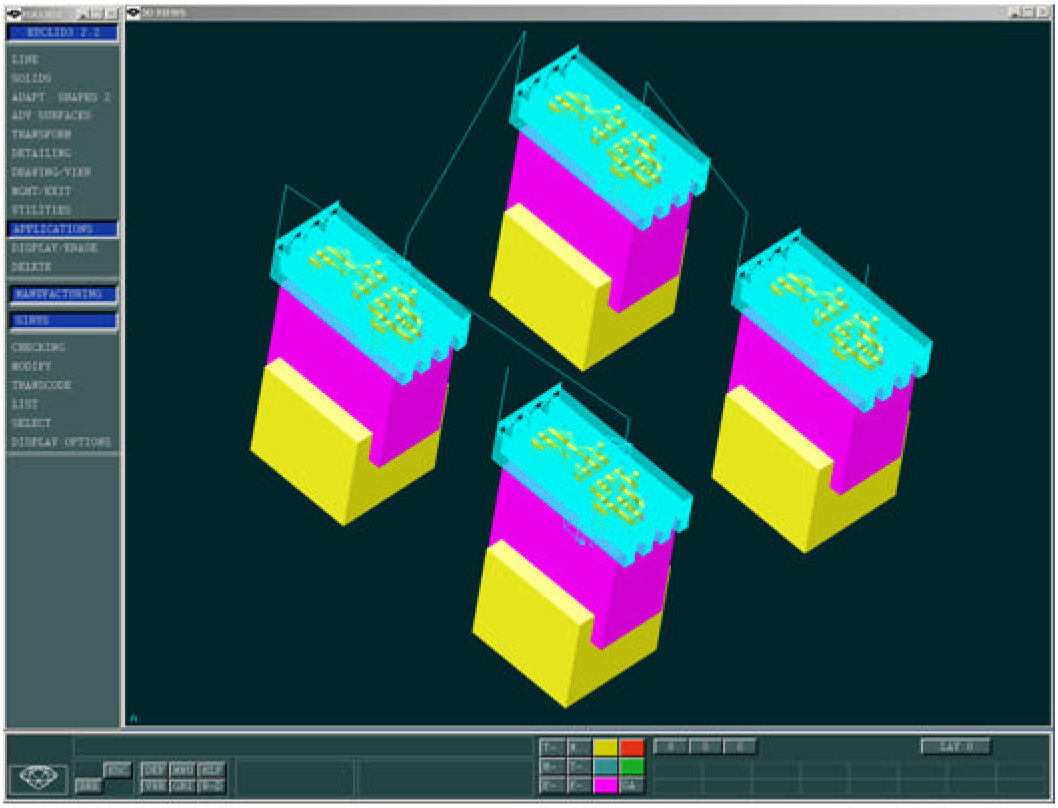

Fig.5. Total mill trajectory during the coarse-grinding of the four electrodes.

Fig.6 shows the four coarse-grinded electrodes. After coarse-grinding, the Ø6 mill is replaced with a Ø2 mill and the finishing program is run. The mill follows the trajectory commanded by the computer, performing the finishing of the four electrodes, one by one. Fig.7 shows the four finished electrodes, simulated in EUCLID3, and fig.8 shows the four finished electrodes [1].

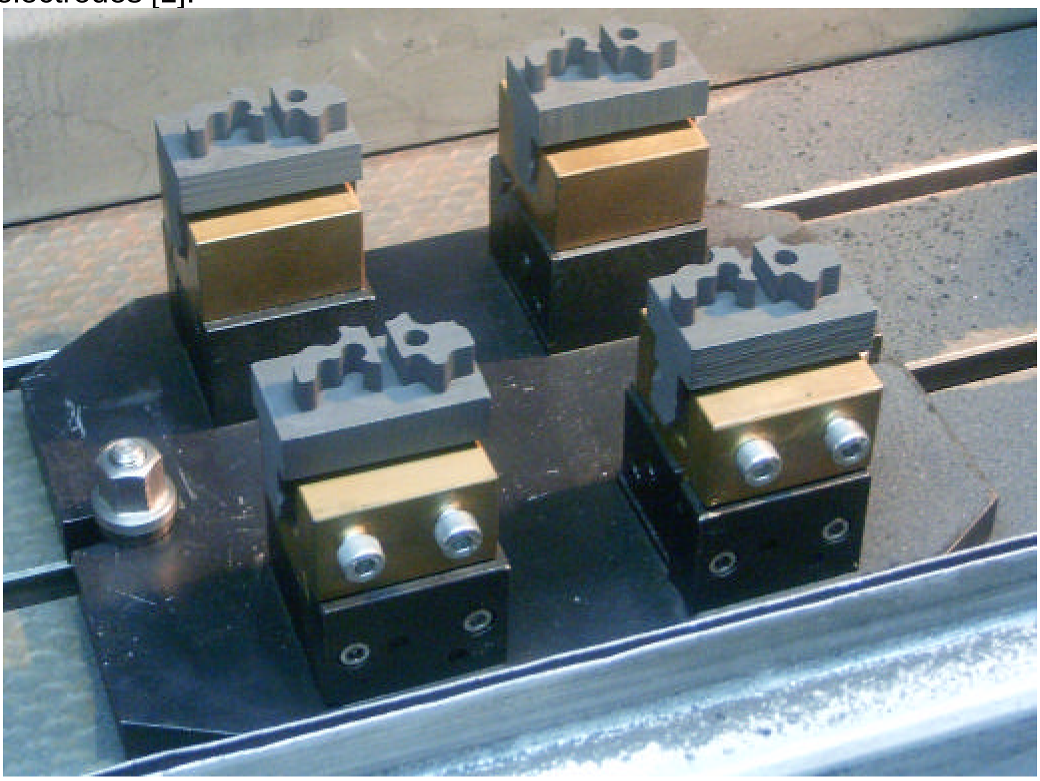

Fig.6. The four electrodes, coarse-grinded.

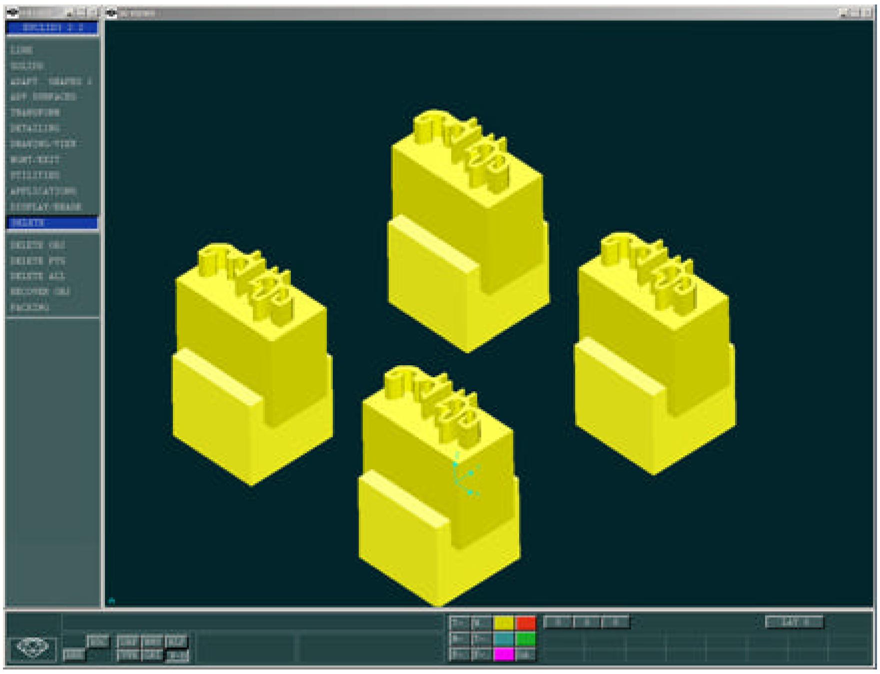

Fig.7. The four electrodes, simulated in EUCLID3.

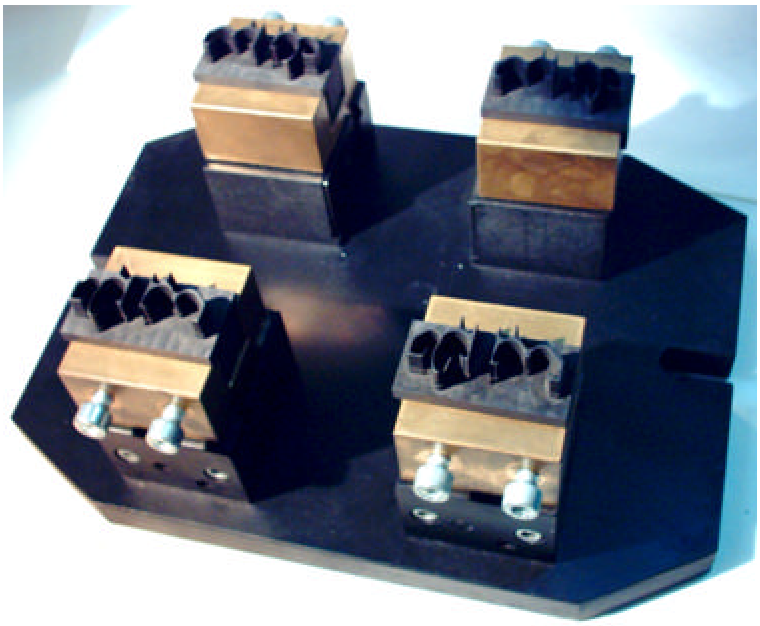

Fig.8. The four electrodes, finished.

4. CONCLUSIONS

Nowadays, in mould and electrode making, the routine work is abandoned in favour of rational design system. Thus, the CAD-CAM systems have evolved, coming to integrated systems based on numerical computing systems, which connect the mould construction, fabrication programming and the effective realization of the parts on modern numerical commanded machines.

The usage of modular devices leads to the following advantages: assuring a high coaxiallity between the tool-electrode, the electrode grip device and the port-electrode; reducing of the preparation time, increasing of the processing precision; possibility of simultaneously processing up to four electrodes, identical or not (coarse-grinding, finishing etc) on the same device and the same grip.

5. REFERENCES

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