Effort to Improve the Mold Technology

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1. Introduction

All the industries have suffered the drop of market due to the worldwide recession. Our company was no exception, and suffered decrease in order.

To develop new products and meet the needs of the market even in such a situation is the important element to overcome the recession.

Facility investment is necessary for developing new products, especially the investment for molding die is essential. There is a large amount of this die investment in the Cooling Systems Division, and we have made an effort to enhance the self-manufacturing of the die for plastic molding die.

This document introduces the enhancement of the molding die technologies that support the development of new products.

2. Effort to Self-manufacture Plastic Molding Die

2.1 Role of plastic molding die in the cooling fan

Our fans fall roughly to an aluminum frame or a plastic frame. Since the fans are small and for their intended purposes, the majority of fan is plastic frame. Aluminum frame is restrictively used mainly to ensure strength or to enhance further high reliability. Therefore, most of the newly developed fans are made with plastic frame.

Also, out of the parts that constitute the fan, frame, impeller, and insulator are plastic molded parts, resulting in 2 to 4 dies required for each of new development. It is necessary to create a vast amount of die every year, and therefore the die investment becomes very large. Fig. 1 shows the transition of facility investment before the self-manufacturing of the molds.

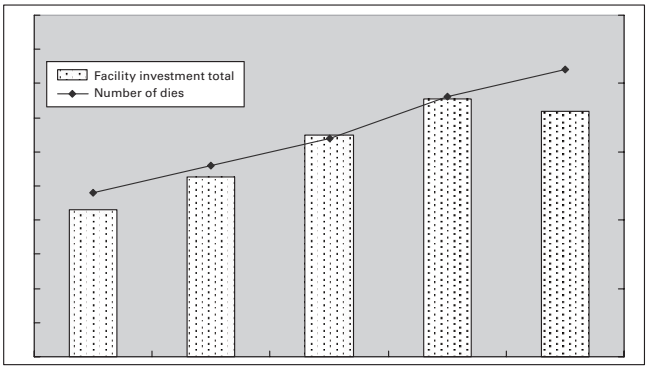


Fig. 1: Transition of facility investment for dies before self-manufacturing

2.2 Effort to self-manufacture plastic molding die

In such situations, we have started thorough enhancement of the self-manufacturing of the dies with the following targets:

1. 100% self-manufacturing of the dies
   To overcome the recession, suppress the die investment cost by aiming 100% self-manufacturing of the dies for newly developed products.

2. Reduction of die manufacturing lead time
   It is very important to reduce the product lead time in order to deliver our new products to our customers as fast as posssible.

3. Improvement of in-company technologies
   By accumulating in-company know-how for die technologies, processing technologies, etc., various proposals can be made for the designing and development.

To realize this, die processing facilities were enhanced, and accumulation of technologies and training of engineers were realized through actual works.

Fig. 2: Die processing facility

2.2.1 Suppression of die investment costs

Self-manufacturing was aimed for suppression of the die investment costs, but the total cost combining the material costs, purchased parts costs, and production man-hour turned out to be more expensive compared to dedicated die manufacturers in the initial stage. The major reason for this was that the man-hour has increased due to manufacturing in inefficient process because we were feeling our way in the dark trying to enhance the die technology.

When the production man-hour was analyzed, half of the process were covered by the hand finishing processes such as round shape processing and die polishing. To reduce the man-hour, hand finishing processes were reduced by creative effort with the machining methods. Initial reduction target was met by these efforts.

Fig. 3 shows the transitions before and after the improvement of the die process.

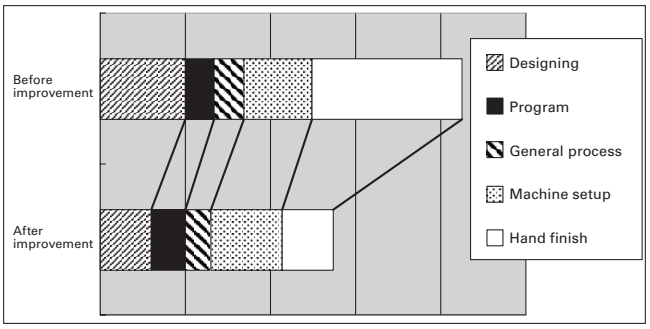


Fig. 3: Transition of die process

2.2.2 Reduction of die manufacturing lead time

The lead time of die manufacturing was not reduced for the die manufactured initially. As described in the previous section, the man-hour increased for the die initially manufactured, and the lead time resulted in being longer. Aiming for shorter lead time, not only the reduction of production man-hour, but also the reduction of processing time was also executed.

When the processing of die parts was analyzed, it revealed that a long time was spent on the electric discharge machining. For the electric discharge machining, in addition to the actual processing with the electric discharge machining equipment, there is a secondary manufacturing process to manufacture the electrode to be used for processing. Therefore, reducing the percentage of electric discharge machining results in the reduction of manufacturing time.

What we focused was the milling process performed on the machining center. By using an extra fine end mill, we finished out the parts that conventionally used electric discharge machining, it was possible to eliminate the electrode manufacturing process that was necessary for electric discharge machining. Fig. 4 shows the transitions of the machining time for single die manufacturing.

The electric discharge machining time is reduced drastically after the improvement.

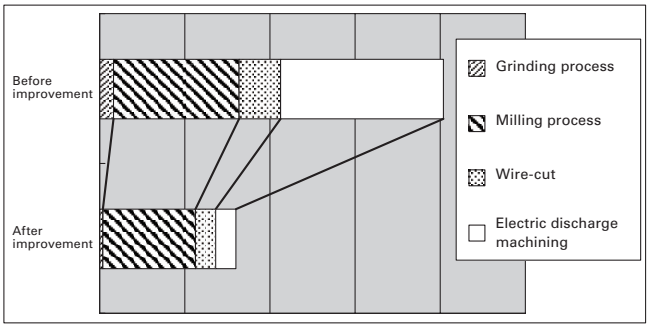


Fig. 4: Transition of machining time

The whole lead time was also reduced due to simultaneous development of product designing and die designing by self-manufacturing.

2.2.3 Improvement of in-company technologies

In the process of self-manufacturing of the die, various problems arose, and each was solved by making improvements accordingly. A vast amount of technologies were accumulated in the company by this.

Especially with the sharing of the data from the product design to the die design with 3D data as a core has advanced the die design and die production dramatically.

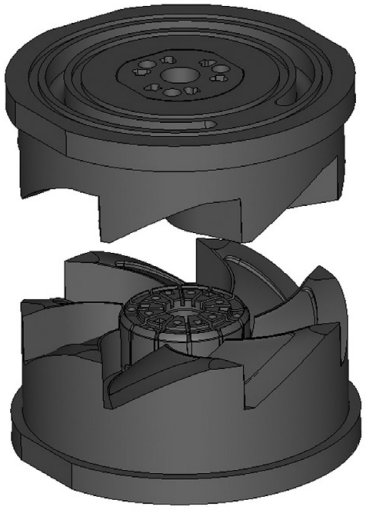


Fig. 5: Die design by the 3D data

Also, with the processing technology, we were able to acquire the skill of not only the manufacturing of the die, but also model machining by easily processing the 3D forms represented by the impeller.

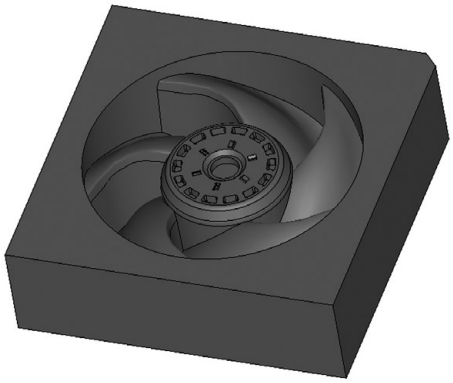


Fig. 6: Cutting of the impeller model

Such enhancement of in-company technology has allowed us not only the product designing support, but also the complicated jig process.

3. Evolving Die Technology

3.1 Movement of further reduction of lead time

To supply the product that matches the customers' need timely into the market and secure the order, the reduction of prototype lead time is very important.

3.2 Effort to reduce the delivery time of new products

The biggest challenge of the short delivery time of the sample for a new product is the lead time to create dies for new parts. Conventionally, we were using these mass production dies to produce sample. Therefore, sample production had to wait until the mass production dies were completed.

To reduce the delivery time of the new products, we have adopted our unique simplified die utilizing the technologies nurtured by self-manufacturing of the die. The delivery time of the prototype was also reduced by selecting the die material focusing on the workability.

3.2.1 Utilization of the simulation technology

In the activities to reduce the prototype delivery time, we have adopted the injection molding analysis to simulate the flow of plastic during the design of the die to reduce the predictable problems, resulting in the reduction of modification of the die at the startup. With this, it was possible to secure the die completion dates.

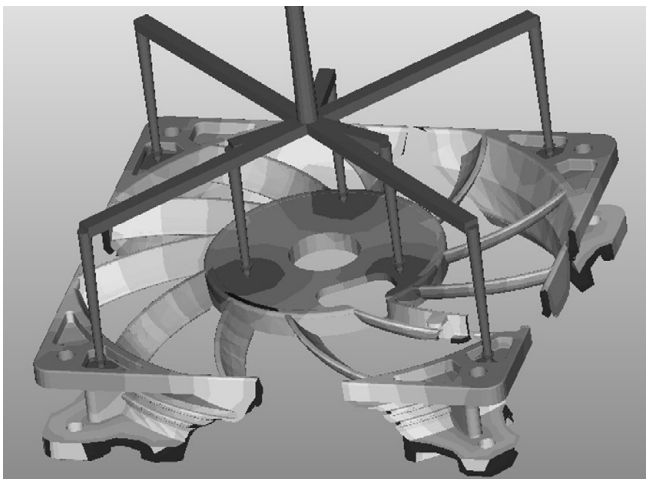


Fig. 7: Injection molding simulation

With these challenges to reduce the delivery time, enhancement of the mold technology was achieved.

3.3 Summary

We were able to overcome the recession by enhancing our technologies with these actions to reduce the delivery time, increasing the rate of self-manufacturing of the die.

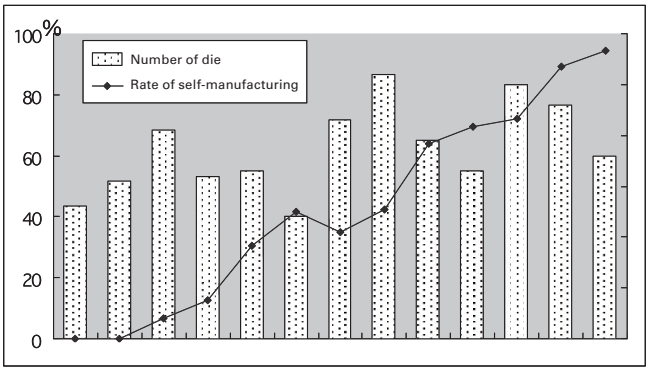


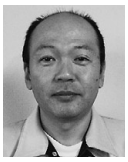
Fig. 8: Transition of rate of self-manufacturing of the die

4. Conclusion

This concludes the overview of the die technology as the "Technologies Used to Overcome the Recession". The largest effect of this effort is the accumulation of the technology in our company, and the main factor that self-manufacturing of the die has made such success was the determination of each member to the manufacturing.

We will continue to search for methods that can manufacture faster with lower cost, support the development of products, and supply attractive new products ahead of the market. This will be our biggest advantage to overcome any recession in the future.

We will continue to improve on daily basis and enhance the die technology so that we can strongly back up the product development.



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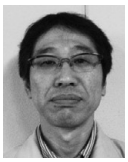

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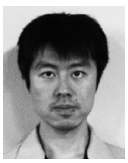

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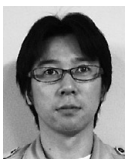

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