UNIT-1- INTRODUCTION

What is Rapid Tooling?

Rapid Tooling is any method or technology that enables rapid production of parts, which will function as a tool (primarily die or mold).

The term Rapid Tooling (RT) is literally described as a process that either uses Rapid Prototyping (RP) process to fabricate the mold directly or utilizes a Rapid Prototyping (RP) model as a pattern to produce a mold quickly. Generally, Rapid Tooling (RT) can be classified in 2 main types - **Direct and Indirect**.

Rapid Tooling VS Rapid Prototyping

Rapid Tooling is any method or technology that enables rapid production of parts, which will function as a tool (primarily die or mold). In manufacturing industry, one of the most common Rapid Tooling methods - Injection Mold Tooling is utilized as Rapid Tooling channel to produce injection-molded parts quickly and inexpensively.

Rapid Prototyping refers to any method or technology that enables rapid fabrication of a physical part that could be used as a prototype or end-use functional product. Common types of Rapid Prototyping technology are as following:

- (I) Additive Manufacturing (3D printing)
- (II) Subtractive Manufacturing (CNC Machining)

For entrepreneurs or small business looking to get their ideas on the market fast, **Rapid Tooling** and **Rapid Prototyping** are particularly the best and quickest way for new product development in comparison to conventional manufacturing method.

Benefits of Rapid Tooling

1. Faster Time to Market

In conventional tooling method, multiple manufacturing processes and techniques might be involved in product development cycle. This may increase the time spending on each step and extend the time from design turning into a real product. Rapid Tooling involves fewer steps than conventional tooling method. Rapid Tooling enables speeding up the whole process. The faster you can get through the prototyping and molding process, the sooner you can finalize your design and get it into the customers' hand.

2. Lower Cost

The longer time spending on product development cycle, the greater the cost will be. The Rapid Tooling advantage of speed could save your business money over time.

3. Variety of Material Grades

Rapid Tooling allows you to use the actual production grades of material. You can use Rapid Tooling to fabricate custom mold quickly. You can then produce as many prototypes from this mold as you can, creating parts with different material grades and test on their properties. This will allow you to have a clearer picture on which material grade performs best in real world application and allow you to make the correct material selection before launching the new product in the market.

4. Designs and Functionality Testing

Rapid Tooling allows the mold to be fabricated in a short timeframe. Hence, this provides more freedom to test out the new ideas and make design adjustments. The parts can be mechanical tested such as impact and stress testing to explore the design flaws before production. This will massively prevent a lot of issues arisen during the future high volume production stage.

5. Process Parameter Testing

Rapid Tooling can also be used to test the process parameter during production stage. For example, different injection speed and mold temperature for injection molding process will affect the part quality. In this way, the engineers and designers could have more measure control on the final part.

Choosing the Best Rapid Tooling Process

Although there are a lot of advantages in Rapid Tooling process, Rapid Tooling is not always suited for all projects. One of the drawbacks of Rapid Tooling is precision. Rapid Tooling might not be as precise as conventional tooling. However, it becomes less concern nowadays thanks to the technology advancement in the 3D printing and CNC machining technology, which shows great improvement in precision and accuracy.

Before starting your project, always consult with an experienced manufacturer your requirement and expectation. Main factors that will decide whether Rapid Tooling process is appropriate for you project are as following:

- Project Budget
- Product Development Timeframe
- Part Specification & Tolerances
- Multiple Materials to be tested?
- Mold or Die to be used for large-scale production?

The upfront clear and well communication with manufacturer will help manufacturer determine which process is your best option. It will save you a lot of time and fortune with relatively ease in your project from prototyping stage to manufacturing stage.