An Introduction to Vacuum Casting and the High Performance of Nylon (PA6)

～Technical collaboration with SLM Solutions (Germany)～

Process Overview

Our nylon casting aims at delivering high quality parts – comparable to mass-production parts – at a low cost.

Photo 1 : Vacuum casting equipment

Vacuum Casting #1

～ About Vacuum Casting, Part I ～

”Vacuum casting“ is an innovative, low-cost production method using a silicone mold. This is an alternative production solution to high-cost metal molds, aimed to drastically minimize initial development costs.

(1) Procedure for Manufacturing Silicone Mold

It takes just 1 day to complete a silicone mold

Vacuum Casting #2

～ About Vacuum Casting, Part II ～

A silicone mold will typically yield about 20 parts. Each part takes approximately 60 minutes to cure. Therefore casting is a solution best for prototypes or small production quantities.

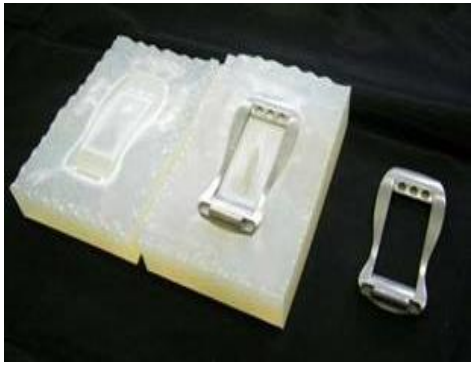


Photo 2: Silicone mold & prototype

(2) Procedure for Casting a Silicone Part

(3) Classification of Plastics

Plastic

- Thermoplastic resin
  - It is not able to withstand because the silicone mold can not endure the pressure
- Thermosetting resin
  - It is used as a conventional vacuum casting resin

Vacuum Casting #3

～ Traditional Drawbacks of Vacuum Casting, Part I ～

Silicone has properties that are similar to rubber and is not able to withstand high pressures like a metal mold can when injecting thermoplastic resins with high pressures. Therefore silicone molding is **limited to thermosetting resins.**

Vacuum Casting #4

～ Traditional Drawbacks of Vacuum Casting, Part II ～

Thermosetting resins (urethane epoxies) usually are brittle and damage easily.

Vacuum cast parts are different from their thermoplastic equivalents due to the chemical process during curing. Therefore parts are typically not suitable for heat resistant applications.

Photo 3: Cast parts from a silicone mold

(4) Purpose of Use

Development Stage	Purposes of Prototype	
Planning (Proof of Principle Model)	Principle Function Review	First step
Design（Mock-up model）	Product Design Review	Second step
Detail Design（Engineering Model）	Assembly Design Review	Third step
Testing（Functional Model）	Functional Evaluation	Fourth step

Mass Production

Cast parts may be used throughout the development process, however, due to the lack of heat resistance, cast parts typically would not be appropriate for the final step prior to production.

A soft tool (AL or soft steel) may be used to mold parts using a thermoplastic resin.

Casting with Nylon #1

～ Introduction to Nylon Casting Equipment, Establishing a Method ～

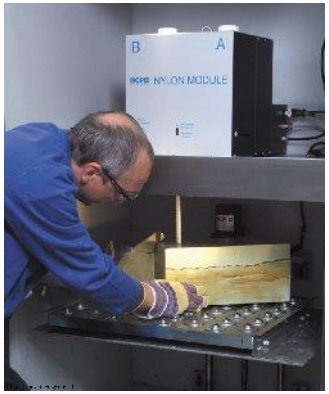
The vacuum casting equipment was jointly developed with a SLM Solutions, GmbH. We were first introduced to the company and their vacuum casting equipment in 2005. We found that the innovative method of vacuum casting was capable of producing comparable production parts. We obtained the sole right to sell the equipment in the Japanese market and became the pioneers in nylon casting.

Through trial an error, we have streamlined the casting process and therefore improved on production time and costs.

Photo 4: Nylon casting equipment

Procedures for Nylon Casting


1 Fill nylon resin in reservoir



2 Place silicone mold

3 Close doors and run program


4 Remove parts

Cast nylon products have the property of nylon PA6

Casting with Nylon #2

～ Superior Properties of Nylon ～

Cast nylon can be up to 18 times better in performance than ABS on impact tests and withstand up to 225° C

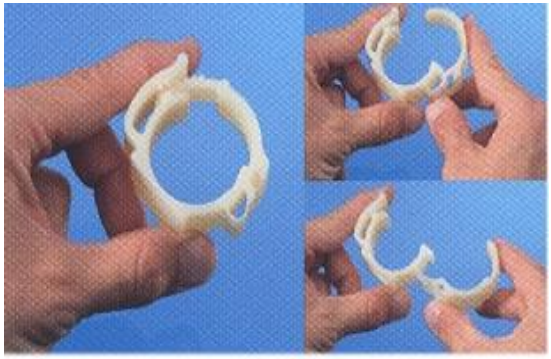
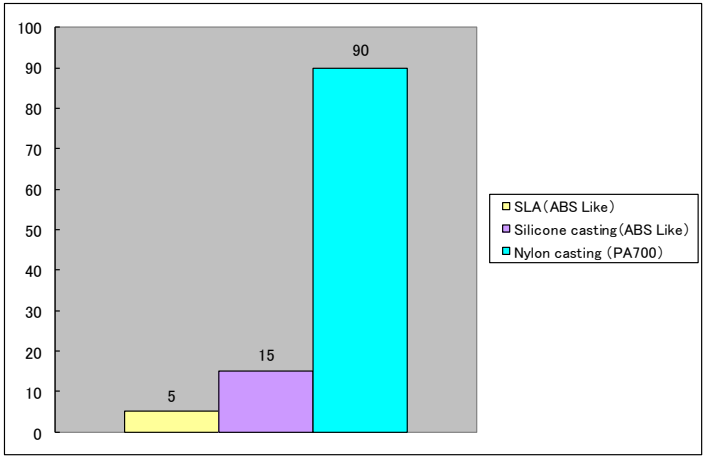
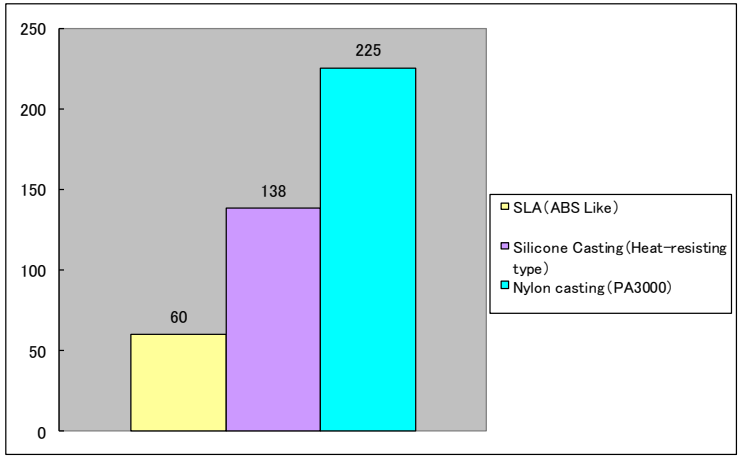


Photo 5: Opening and closing of a hinge on a nylon casting

Impact test（kJ/㎡）



Heat deflection temperature（℃）



Cast nylon is more impact resistant and heat resistant than traditional casting materials and rapid prototyping materials.

Cast nylon is also durable for living hinges. (Photo 5)

Casting with Nylon #3

～ Market Response ～

After we introduced the nylon casting process, we received 5,000 hits per day on our website and more than 50 inquiries about the equipment. The reception of the process to the industry exceeded our expectations.

Photo 6：Silicone mold for nylon casting

Nylon casting application examples

List of customers	Parts	conventional methods
car maker ：A	Engine cover, air cleaner	Temporary pattern
car maker：B	Door mirror , engine cover	Temporary pattern
car maker ：C	Column cover , air cleaner	SLS
Automobile Parts makers：D	Intake manifold	Casting
Automobile Parts makers：E	Protector and fuse box	SLS
Motorcycle maker：F社	Rear fender	Temporary pattern
Motor maker：G社	Motor cover	Vacuum casting
Motor maker：H社	Fan	Vacuum casting
Machine tool maker：I社	Exterior parts	CNC
Daily goods maker：J社	Hinge cap	－
Prototype maker：数社	Engine cover , heat appliance parts	

Casting with Nylon #4

～ The Preferred Method ～

Nylon casting reduced development costs by 1/10 or less compared to conventional methods. By demand, it has been replacing parts cast from traditional materials and SLS manufactured parts.

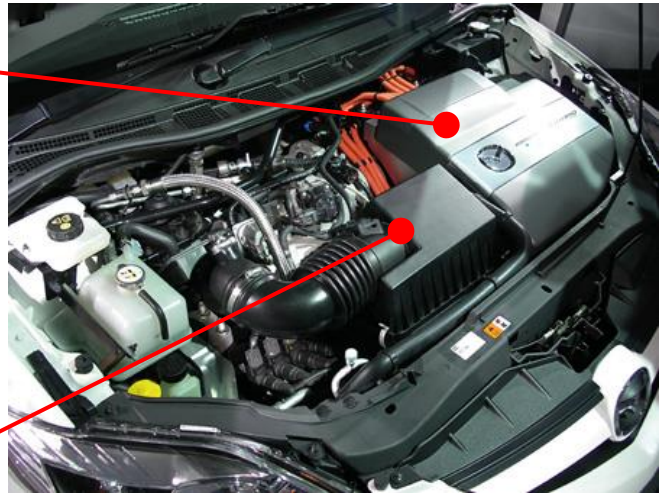
Automotive Applications of Nylon PA6 Cast Parts

Plamerry Design

Cast parts exhibit features of a thermoplastic nylon and used in the same conditions as its mass-produced versions!

Intake Manifold

Engine Cover



Unnecessary to use MOLD!
Low Cost!
Quick Delivery!

Nylon Plus System
GF30% Glass filler mixed
CF20% Carbon filler mixed

Maximum Production Size
800 × 750 × 350mm

Air Filter Housing

Prototyping Method Proposal

Short Run Using Various Processes

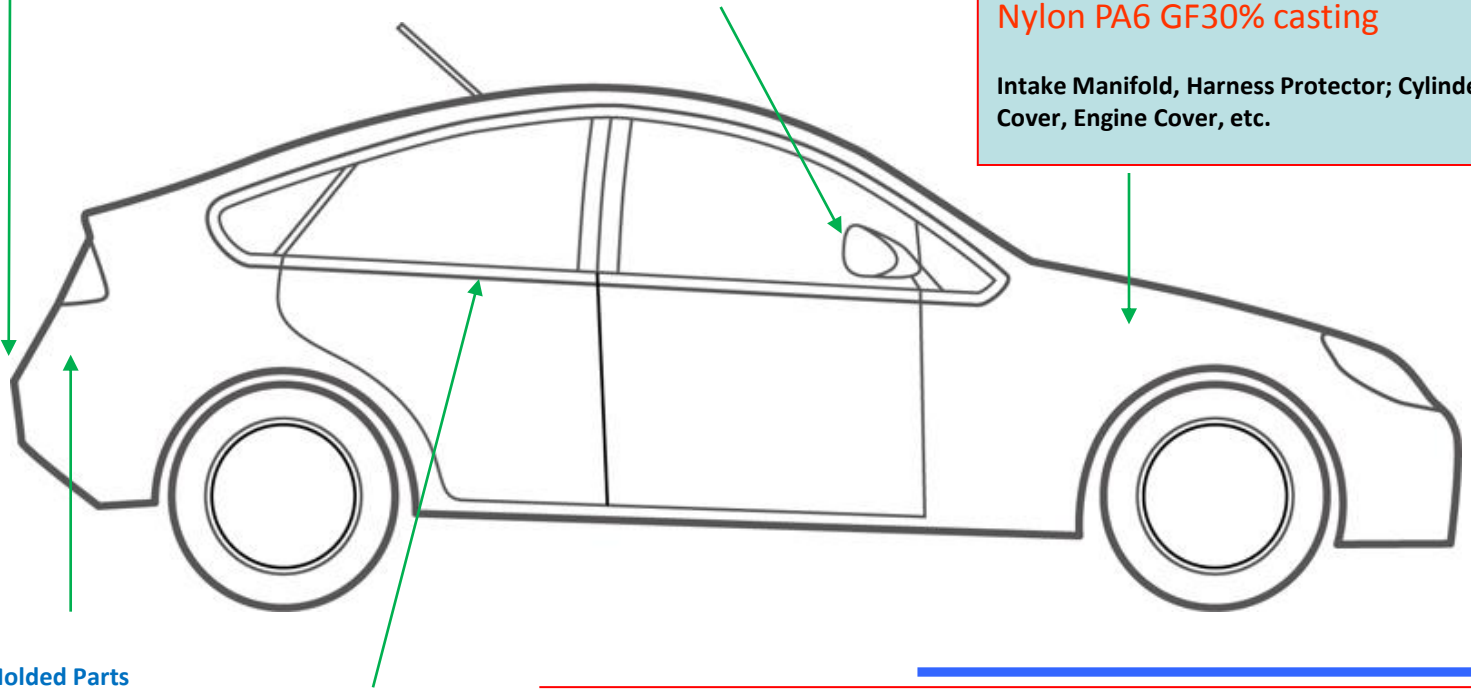
Vacuum Casting・M/C Processing・Optical Modeling・Powder Molding

Interior and exterior bumper grill, Door Mirror-Instrument Panel, Seat Parts etc.

Thermoplastic Vacuum Casting Parts

Nylon PA6 GF30% casting

Intake Manifold, Harness Protector; Cylinder Head Cover, Engine Cover, etc.



Injection Molded Parts

Resin Molding, Aluminum Molding

Various Small-lot Parts of Vehicle

We will suggest to make your products as fulfilling as possible using the most efficient production processing.

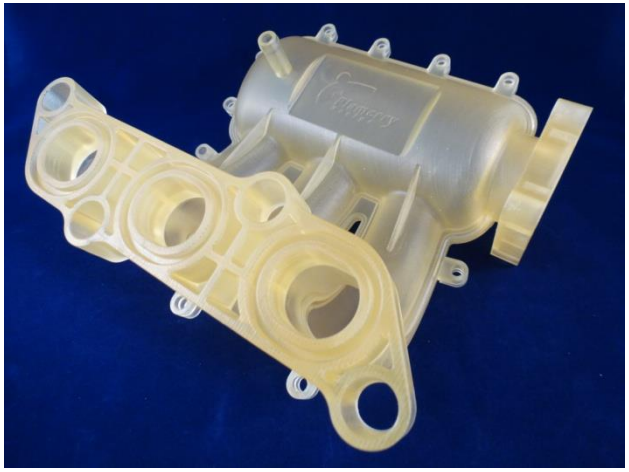
Rapid Prototyping (RP) Stereolithography System

iPro8000EX – High-speed, High-precision!

We are using the top-of-the-line iPro8000EX developed by 3DSystems and sold by JSR Corporation.

The iPro8000EX is capable of high-speed and high-precision products: **Quickly, Clearly, & Accurately**

Resin Material:	**JSR** SCR series resin ⇒**SCR735**
Max Part Size:	**X750×Y650×Z550** ＊ **Maximum weight 75kg**
Data Format:	File data（IGES/STEP/Parasolid) has to be converted to STL



Great For:

- **Design Study**
- **Functional Check**
- **Master Model Production**