

FUNDAMENTALS OF TOOL DESIGN

Rapid Tooling Design

SCENE 1.

RT20A, CGS: Indirect Rapid Tooling Processes
white text, centered on background

SCENE 2.

RT21A, **FMP829**, **07:03:32:00-07:03:52:00**
mold being pulled apart after curing
RT21B, CGS: Room Temperature
Vulcanized Rubber Molding

NARRATION (VO) :

INDIRECT RAPID TOOLING PROCESSES PRODUCE MOLDS BY FORMING THEM FROM A PATTERN. A COMMON EXAMPLE OF THIS TECHNIQUE IS 'RTV', OR ROOM TEMPERATURE VULCANIZED RUBBER MOLDING.

SCENE 3.

RT22A, **FMP828**, **06:11:17:00-06:11:56:00**
pouring of rtv material into mold

NARRATION (VO) :

'RTV' TOOLING, WHICH IS USED FOR GRAVITY CASTING OR LOW-PRESSURE MOLDING OF THERMOSET PLASTICS, INVOLVES THE USE OF 'RTV' SILICONE MATERIALS TO PRODUCE THE MOLDS.

SCENE 4.

continue previous shot
RT23A, **FTD69**, **02:29:48:00-02:30:06:00**
zoom in, rapid prototyping pattern being made for rtv process

NARRATION (VO) :

TYPICALLY, THE PATTERN USED TO PRODUCE THIS TYPE OF INDIRECT RAPID TOOLING IS CONSTRUCTED USING A RAPID PROTOTYPING MACHINE.

SCENE 5.

RT24A, cad image of glove box showing draft angle of side walls
RT24B, **FTD70**, **04:09:55:00-04:10:12:00**
zoom in, cad part being looked at

NARRATION (VO) :

TO AID IN PART REMOVAL, DRAFT MAY BE ADDED TO THE PATTERN'S SIDE WALLS. TO COMPENSATE FOR THE NET SHRINKAGE OF THE

MOLD MATERIAL AND THE PLASTIC FOR THE PART, THE PATTERN'S SIZE MAY BE ADJUSTED.

SCENE 6.

RT25A, FTD70, 04:11:01:00-04:11:51:00
cad pattern file converted to stl file

NARRATION (VO) :

FOLLOWING PATTERN DESIGN, AN 'STL' FILE IS EXPORTED FROM THE 'CAD' SOFTWARE PROGRAM, PREPARED FOR RAPID PROTOTYPING, AND THEN DOWNLOADED TO THE MACHINE.

SCENE 7.

RT26A, FMP830, 08:10:27:00-08:10:50:00
zoom in, rapid prototyping of pattern

NARRATION (VO) :

UNLIKE MACHINING AND FABRICATION PROCESSES, THE BUILD TIME FOR THE PATTERN IS DEPENDENT ON ITS SIZE AND MASS, NOT THE LEVEL OF DETAIL AND NUMBER OF FEATURES.

SCENE 8.

RT27A, FMP830, 08:28:56:00-08:29:09:00
pattern being post processed
RT27B, FTD70, 04:01:34:00-04:01:57:00
zoom out, pattern being post processed
RT27C, FTD70, 04:04:34:00-04:04:53:00
pattern being sealed

NARRATION (VO) :

FOLLOWING THE PATTERN'S CONSTRUCTION, IT IS POSTPROCESSED TO PREPARE IT FOR MOLD CREATION. THIS OFTEN ENTAILS FILLING OF BUILD LINES, FINE FINISH SANDING, AND APPLICATION OF A PATTERN SEALER.

SCENE 9.

RT28A, FMP842, 12:03:43:00-12:03:58:00
prepared rapid prototyped pattern
RT28B, FMP842, 12:06:19:00-12:06:31:00
pattern secured in clay, parting line defined
RT28C, FMP842, 12:08:35:00-12:08:50:00
frame built around pattern

NARRATION (VO) :

ONCE POST PROCESSED, DEVELOPMENT OF THE FIRST MOLD HALF TYPICALLY BEGINS BY SECURING THE PATTERN IN OIL-BASED CLAY, OR OTHER BUILDING MATERIALS, AND CONSTRUCTING THE PARTING LINE..., THEN, THE PATTERN IS SECURED IN A BOX OR

FRAME.

SCENE 10.

RT29A, FMP842, 12:23:51:00-12:24:16:00
rtv molding material pour around pattern
half
RT29B, FTD68, 01:44:07:00-01:44:25:00
rtv tooling in vacuum

NARRATION (VO) :

SILICONE 'RTV' MOLDING MATERIAL IS THEN
POURED AROUND THE PATTERN AND ALLOWED TO
CURE. TYPICALLY, IT IS NECESSARY TO
APPLY A VACUUM TO EITHER THE 'RTV'
MOLDING MATERIAL BEFORE POURING, OR THE
TOOLING ASSEMBLY AFTER POURING TO REMOVE
AIR BUBBLES FROM THE MOLDING MATERIAL.

SCENE 11.

RT30A, FMP842, 12:10:39:00-12:10:52:00
box removed from first mold half
RT30B, FMP842, 12:14:26:00-12:14:37:00
sealing ring cut
RT30C, FMP842, 12:15:37:00-12:15:43:00
building box around first mold half
RT30D, FMP842, 12:17:09:00-12:17:16:00
release sprayed on pattern box
RT30E, FMP842, 12:18:28:00-12:18:44:00
vent poles added to pattern box

NARRATION (VO) :

ONCE THE SILICONE HAS CURED, THE BOX IS
REMOVED...,
AND THE MOLD HALF AND PATTERN ARE
PREPARED FOR THE POURING OF THE SECOND
MOLD HALF...,
THIS PREPARATION CAN INCLUDE A RELEASE
AGENT COATING TO ENSURE SEPARATION OF
THE MOLD HALVES.
IT MAY ALSO INCLUDE ADDING A GATE FOR
INJECTION, AND VENTING TO ALLOW AIR IN
THE MOLD TO ESCAPE.

SCENE 12.

RT31A, FMP842, 12:23:07:00-12:23:38:00
zoom in, second mold half poured
RT31B, FMP842, 12:21:29:00-12:21:37:00
mold halves separated
RT31C, FMP842, 12:21:46:00-12:21:51:00
pattern removed from mold
RT31D, FMP842, 12:22:01:00-12:22:30:00
mold halves prepared for injection

NARRATION (VO) :

ONCE PREPARED, THE SECOND MOLD HALF IS
POURED, AND ALLOWED TO CURE...,
AFTER CURING, THE MOLD HALVES ARE
SEPARATED ALONG THE PARTING LINE...,
THE PATTERN IS REMOVED...,

AND THE MOLD IS PREPARED FOR USE.

SCENE 13.

RT32A, FTD70, 04:14:51:00-04:15:10:00
zoom out, part pulled from rtv mold

NARRATION (VO) :

'RTV' TOOLING CAN BE USED TO MOLD SMALL TO MEDIUM QUANTITIES OF PARTS OUT OF A LARGE VARIETY OF URETHANE, EPOXY OR OTHER POLYMER MATERIALS.

SCENE 14.

RT33A, FMP829, 07:08:16:00-07:08:32:00
mold put together
RT33B, FMP829, 07:12:21:00-07:13:12:00
molding of parts using rtv mold
RT33C, CGS: Casting Material
Accuracy & Finish
Requirements
Complexity of the
Part Geometry

NARRATION (VO) :

'RTV' TOOLING CAN TYPICALLY BE USED TO MOLD MANY PARTS BEFORE REPLACEMENT TOOLING BECOMES NECESSARY. THE TOOL LIFE DEPENDS ON THE CASTING MATERIAL, ACCURACY AND FINISH REQUIREMENTS, AND THE COMPLEXITY OF THE PART GEOMETRY.

SCENE 15.

RT34A, FMP828, 06:16:51:00-06:17:10:00
simple mold halves put together
RT34B, FMP829, 07:23:54:00-07:24:05:00
complex mold halves put together
RT34C, FMP829, 07:26:18:00-07:26:56:00
molding material injected into mold
RT34D, FTD68, 01:30:32:00-01:30:48:00
zoom out, part pulled from mold

NARRATION (VO) :

DOZENS OF SIMPLE PARTS CAN BE PRODUCED FROM A SINGLE SILICONE RUBBER MOLD, BUT TEN TO TWENTY IS TYPICAL IF THE PARTS ARE MORE COMPLEX. WEAR OF THE MOLD OCCURS DUE TO THE EXOTHERMIC AND REACTIVE NATURE OF THE THERMOSET MATERIALS, AND BECAUSE OF THE NECESSITY TO MECHANICALLY DEFORM THE MOLD TO REMOVE PARTS.

--- FADE TO BLACK ---