Week 9: Molding and Casting

25.3. 2015

This week we will learn about molding and casting.

The agenda: http://academy.cba.mit.edu/classes/molding_casting/index.html

molding **types** injection (sprue, runner, gate, vent, parting line, flashing) insert vacuum blow rototional flexible, soft parts **materials** machineable wax low-temp wax rigid foam gesso alginate gel urethane rubber, plastic silicone PDMS (polydimethylsiloxane) latex thermoplastic, thermoset polymers calcium sulfate desicant, coagulant, plaster, gypsum, drywall DryStone Portland cement calcium silicate, aluminum/iron oxide, calcium sulfate Hydro-Stone metal glass ceramic food **additives** fibers (tension, compression, composites) fillers: density, conductivity, flexibility, color, ... **processing** testing mixing deairing pouring starting filling vent location curing polymerization cross-linking hydration endothermic, exothermic demolding taper release agents deformation storage shelf life **safety** MSDS ventilation protection disposal **machining** rough, finish cuts cut depth, shank, collet **software** Roland Modela Player ShopBot VCarvePro fab modules image, mold .stl, .png, toolpath, mold tippy.cad, bottom, top, mold, video

The assignment for this week: design a 3D mold, machine it, and cast parts from it

Class:

Injection moulds - http://fablab.waag.org/archive/casting-foosbal-man-part-2

Insert moulding

Vaccum moulding – pour over

Blow

Rotational

Flexible, soft

Parts

Soft tooling / hard tooling

Matt's project:
http://fab.cba.mit.edu/classes/863.12/people/matted/weekly-projects/6-molding-and-casting.html

Material:
https://docs.google.com/spreadsheet/pub?key=0AtIlZyLn99e6dGRleUJTY043a3FucUhFUVVBYTdxS3c&single=true&gid=0&output=html

Machinable wax: http://www.machinablewax.com/

Save the shavings

Low temperture wax: http://www.dickblick.com/products/amaco-flexwax-moldmaking-material/

Warm it in hot water and use it to make an impression of an object.

Rigid Foam to Casting a large concreate object:
http://www.homedepot.com/p/Owens-Corning-FOAMULAR-250-2-in-x-2-ft-x-8-ft-Tongue-and-Groove-R-10-Insulation-Sheathing-24DD/100320335

Alginage gel: http://www.homedepot.com/p/Owens-Corning-FOAMULAR-250-2-in-x-2-ft-x-8-ft-Tongue-and-Groove-R-10-Insulation-Sheathing-24DD/100320335
Safe to use with people, body parts

Uruthene rubber: http://www.smooth-on.com/PMC=-121---Easy-/c1144/index.html
The surface is very reactive when you have just cast it. Gets slighly better with use, can be dusted.

Uruthene plastic: http://www.smooth-on.com/Urethane-Plastic-a/c5/index.html
Designed to be tinted

Silicone: OOMOO: http://www.smooth-on.com/OOMOO=-Silicone-/c1136/index.html

PDMS – for exact work:
http://www.dowcorning.com/applications/search/products/Details.aspx?prod=01064291&type=PROD

Latex – stay away from it

Silicone & Uruthene – can be mixed

Rubber Latex: http://www.dickblick.com/products/amaco-rubber-latex/

Thermoplastics: http://www.mcmaster.com/#thermoplastics

Drystone: http://plaster.com/DryStone.html plaster + polymers
Hydrostone: http://plaster.com/HYDROSTONE.html plaster + concrete - is stronger structurally

It is not plaster.

Both of these start of as plaster... but the surface definition is very good.

Metal: http://academy.cba.mit.edu/classes/molding_casting/metal.png

Using two material:

Roto metals: http://www.rotometals.com/
Smooth-on: http://www.smooth-on.com/
Has a few materials that is safe for food: food save rubber

West marine: http://www.westmarine.com/

Steps

Fist thing is to mix the materials to make the rubber and then mix the materials to cast

Mixing is not trivial, bubbles should be avoided
Number of ways to avoid them:

1. Avoid them in the first plast, scooping
2. Shearing
3. Not mix enough
4. Put it in a vacum
5. By agitating (for low aire materials, like concrete
6. Pour slowly
7. Filling the mould – have a place to fill, but have a vent
8. Orient the mould in the right way

Curing:

Demoulding: for rigid mould - taper slighly the face, to be able to lift the mould off

Release agent to help slip the mould off

Keep containers clean after use and be aware of the shelf life

Safety:

MSDS:
This one is hazardous: http://www.smooth-on.com/Urethane-Plastic-a/c5_1120_1156/index.html

Read the datasheets and the warnings carefully

You need protection: gloves, eye protection, masks
Clean the workspace, disposable paper at hand

Machining: rough cut to remove material, finish cut, 3D cut to get the surface profile
There is a collet holding the tool, the tool has a shank and a flute
Depth of cut for the tool, clearance for the shank and tool holder

In this week assignment design around the tool

Vcarve

Fabmodules

Carbite Depot – supplier

Start from .stl or

Rough cut and finish cut later

From .png

Design in a 3D program, or 2D program using greyscale

One side mould

Two side mould – align the top and bottom faces

Coocky mould material – bakable:

Smooth-on: Smooth-Sil® 940 Suitable For Food-Related Applications:
http://www.smooth-on.com/a25/Smooth-Sil%3D-940-Suitable-For-Food-Related-Applications/article_info.html

Data sheet: http://www.smooth-on.com/tb/files/FOOD_SAFE_SILICONES.pdf

DXF – save from Rhino

Vcarve pro – software for flat objects

PartWorks – for 3D objects

Using the iModela for routing/cutting the mould
Open Modela Player 4 to load model

Chose Model Name (machine) SRM-20

Chose tools – 1/8, end mill

New Process – chose roughing,

To calculate the volume of liquid for casting the mould:

In Rhino select Analyse – mass properties – volume

136146.874 cubic millimeters to ml = 136.146874 ml

oomoo 25 – brand name – to boxes, blue and yellow
With gloves on mix 50%-50% slowly and pour into mould – hoping not for many bubbles, put it with a cloth between on the radiator to make the bubbles escape

For casting the form – use Hydro-Stone Super X and DryStone Casting Media.