

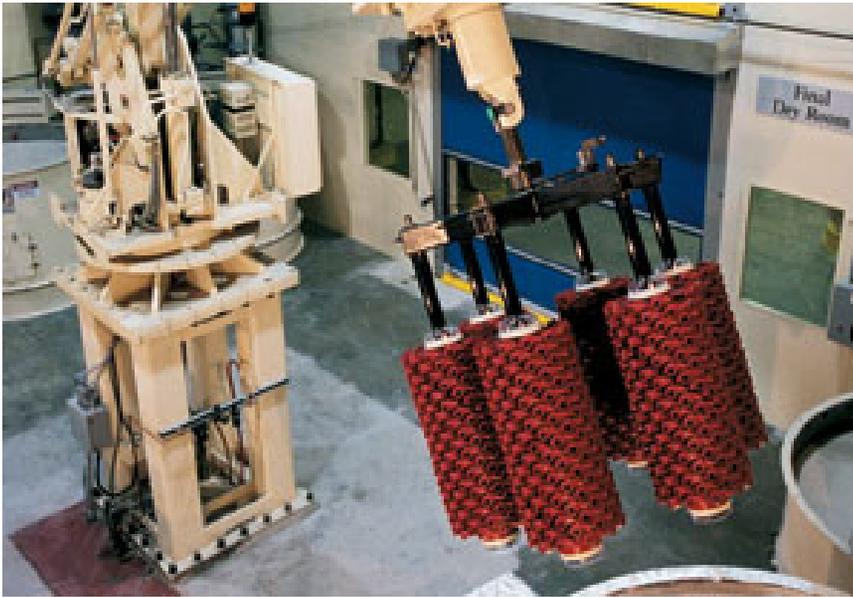
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### 3.A04 Modern Blacksmithing and Physical Metallurgy

Fall 2008

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# Casting Methods & Practice



# Casting Methods

- Lost-Wax (Investment casting)
- Sand Casting
- Lost-Foam Casting
- Casting Principles

# Cast Objects Around MIT

- The following 6 slides show cast sculptures at MIT
  - All are investment cast
  - All are silicon bronze
  - All are artificially patinated
  - Some are cast in multiple parts and welded
  - Others cast in a single pour













# THE LOST-WAX (INVESTMENT) PROCESS



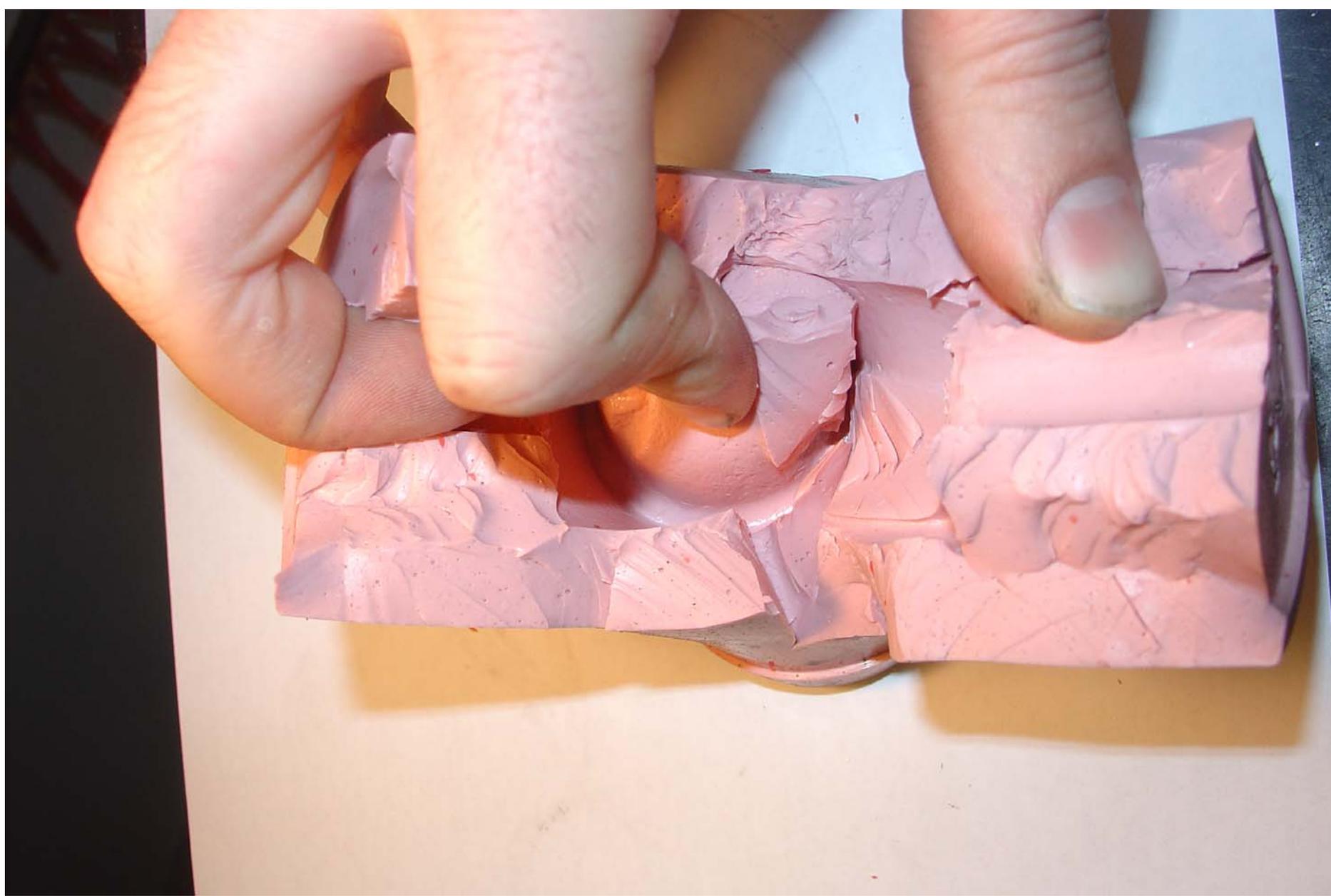
The most crucial part of lost-wax casting is producing a quality wax model. The metal you cast will be a very close replica of your original wax. Even fingerprint-level detail can be transferred from wax to metal. This wax is a wall-mount bottle opener.



One method to produce a wax is to rubber mold an existing object. You can also sculpt or machine wax into shape.



Here is a rubber mold made around the previous bottle opener. Once the rubber hardens, you remove the object and are left with a cavity that is an exact copy of the molded object. Molten wax is then poured into the cavity to produce wax copies.



The inside of the bottle-opener rubber mold, showing the cavity left by the molded object.



A finished wax, as removed from the rubber mold

Waxes >>> “plumbing” >>> mold (investment)



Multiple waxes created from a single rubber mold

# The Anatomy of Casting

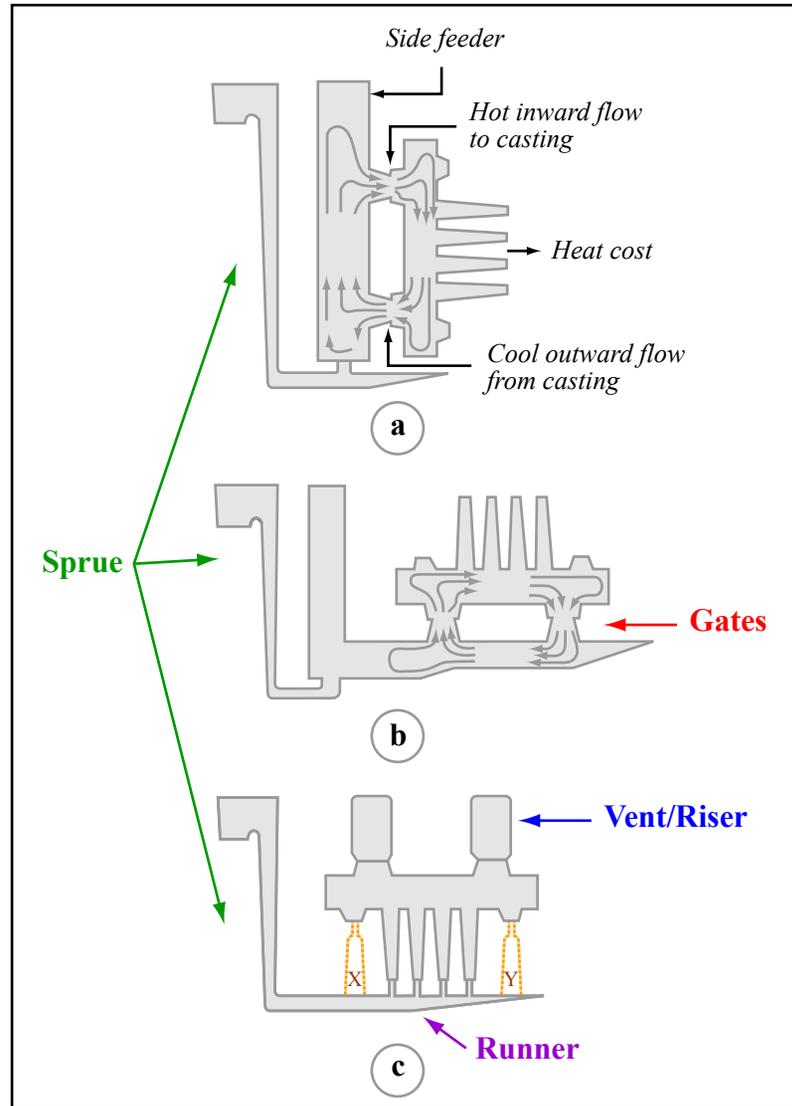


Figure by MIT OpenCourseWare.

# Casting Pitfalls

- Even fill from bottom to top
- Fill thin sections first
- Avoid air entrapment
  - Pay special attention to venting small detail

# Casting Pitfalls

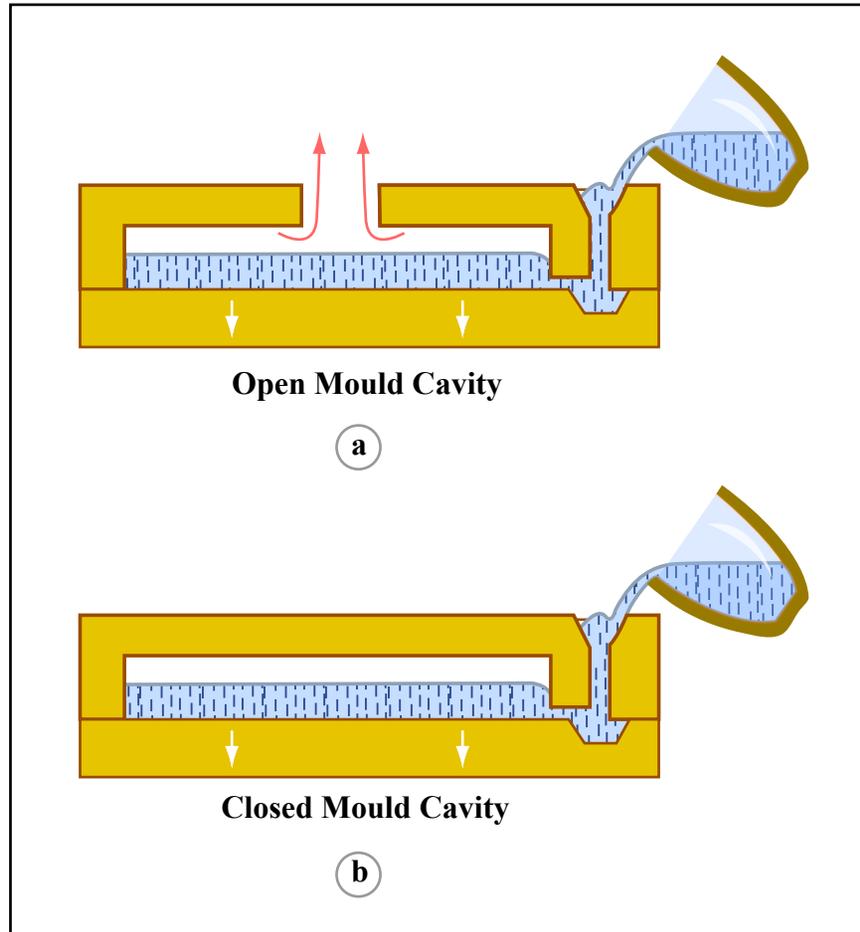


Figure by MIT OpenCourseWare.



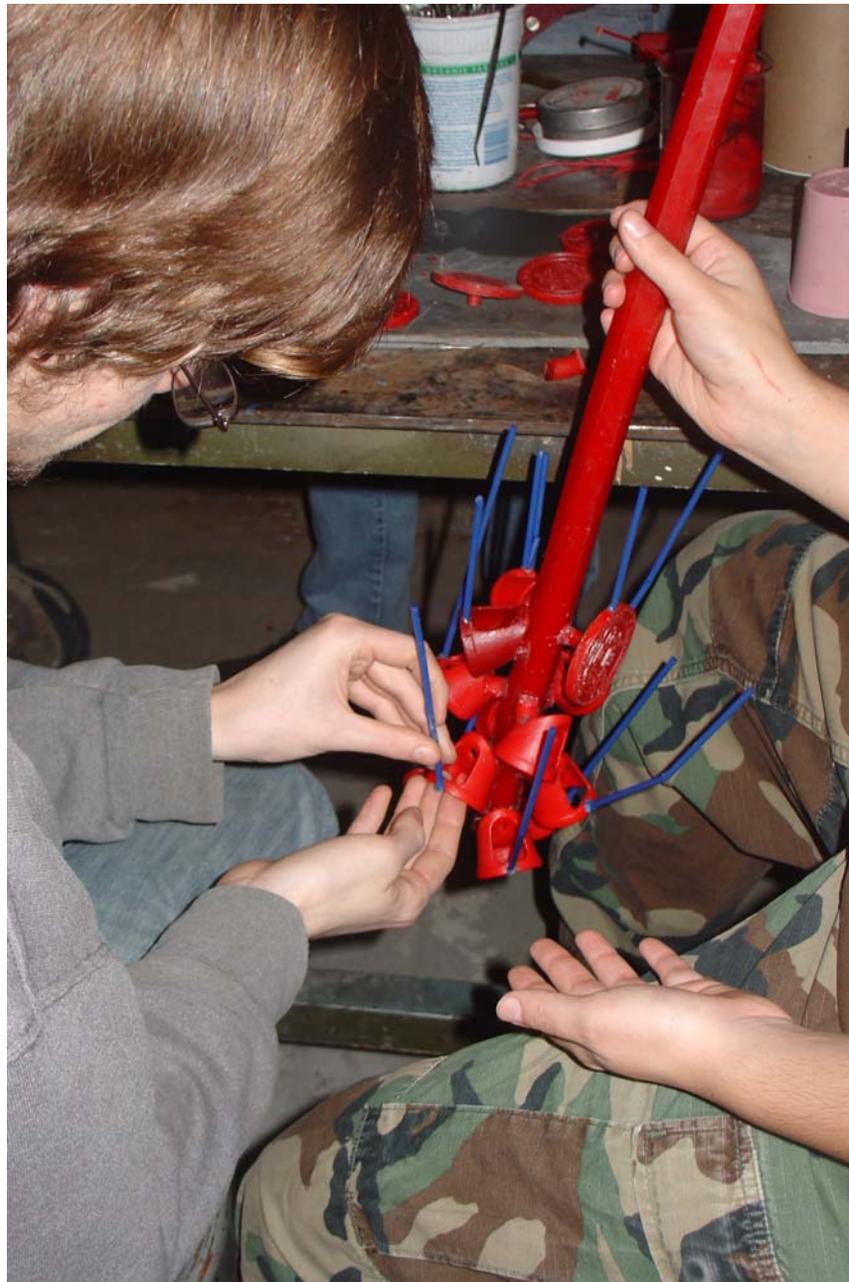
Attaching gates to wax objects using “sticky wax” as adhesive



Attaching gated objects to central sprue to make wax "tree"



A partially finished wax tree of bottle openers



Adding vents to objects to allow air to escape during casting

# MIT Ceramic Mold Material

(Investment)

- Crystalline silica
- Ethyl silicate binder (TEOS)
- Ethanol diluent
- 3% ammonium carbonate catalyst

NEW MATERIAL:

Ransom & Randolph GlassCast 810

Water-based

Plaster/Flint/Fiberclass mixture



Pouring ceramic slurry over a wax tree, contained in a Carboard mailing tube



Removing cardboard tube in preparation for wax burnout



Finished mold with wax sprue evident



Burning ethanol-based binder to de-wax mold



De-waxed ceramic mold ready for pouring  
Once wax is removed, molds are fired/sintered in a furnace



Pouring molten silicon bronze into a ceramic mold



Allowing the metal to cool -- still visibly hot



Removing ceramic investment from cast bottle opener trees



# SAND CASTING METHODS



Above is a sand casting pattern. This is a model of what is cast



Sand casting flasks -- cope & drag -- that form the sand molds





The pattern is placed between the flasks, and foundry sand is rammed into the cope and drag, around the pattern form

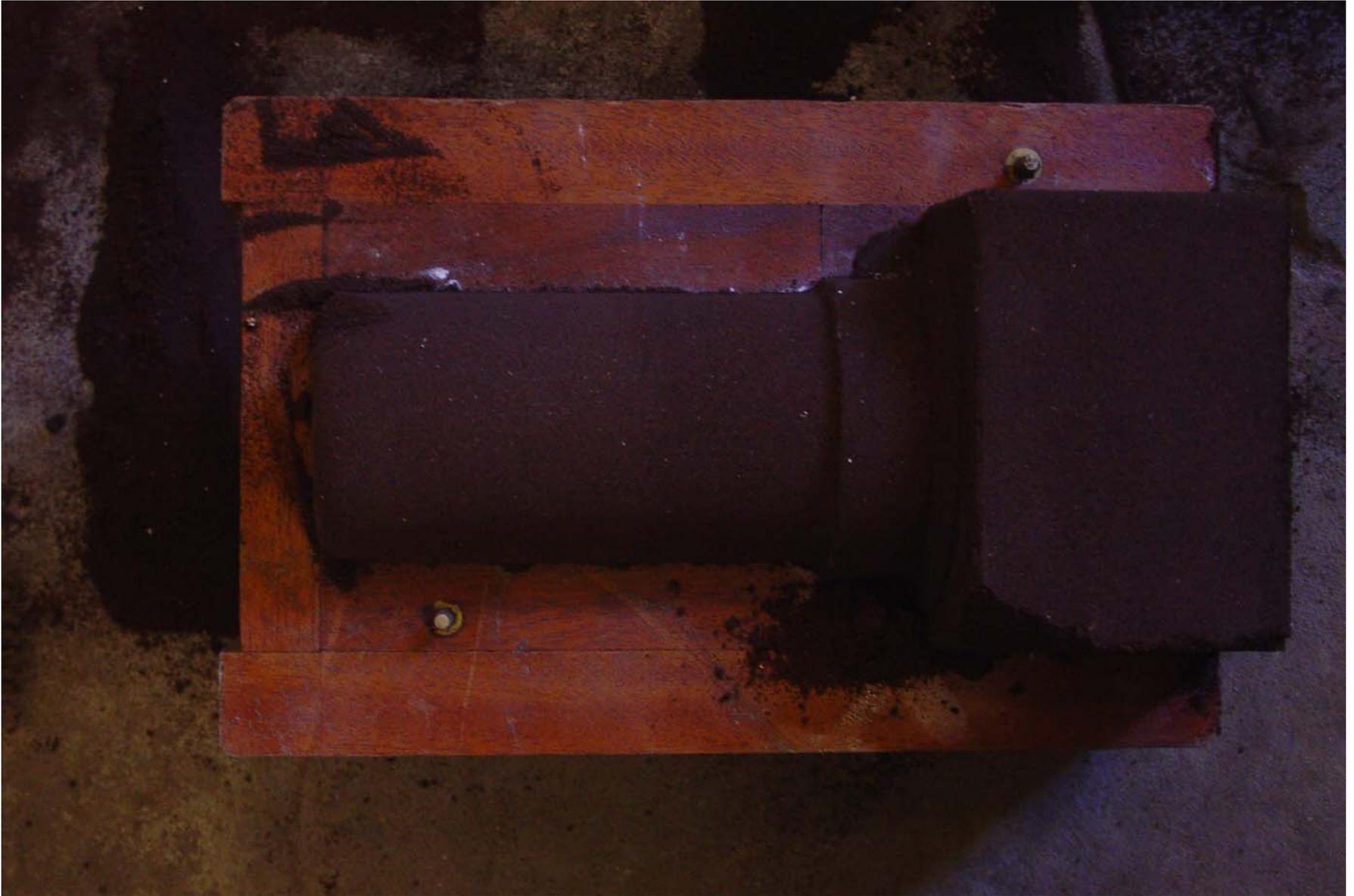


The pattern is removed from the sand flasks, leaving a cavity in the shape of the pattern mug. Metal can then be poured into this cavity.





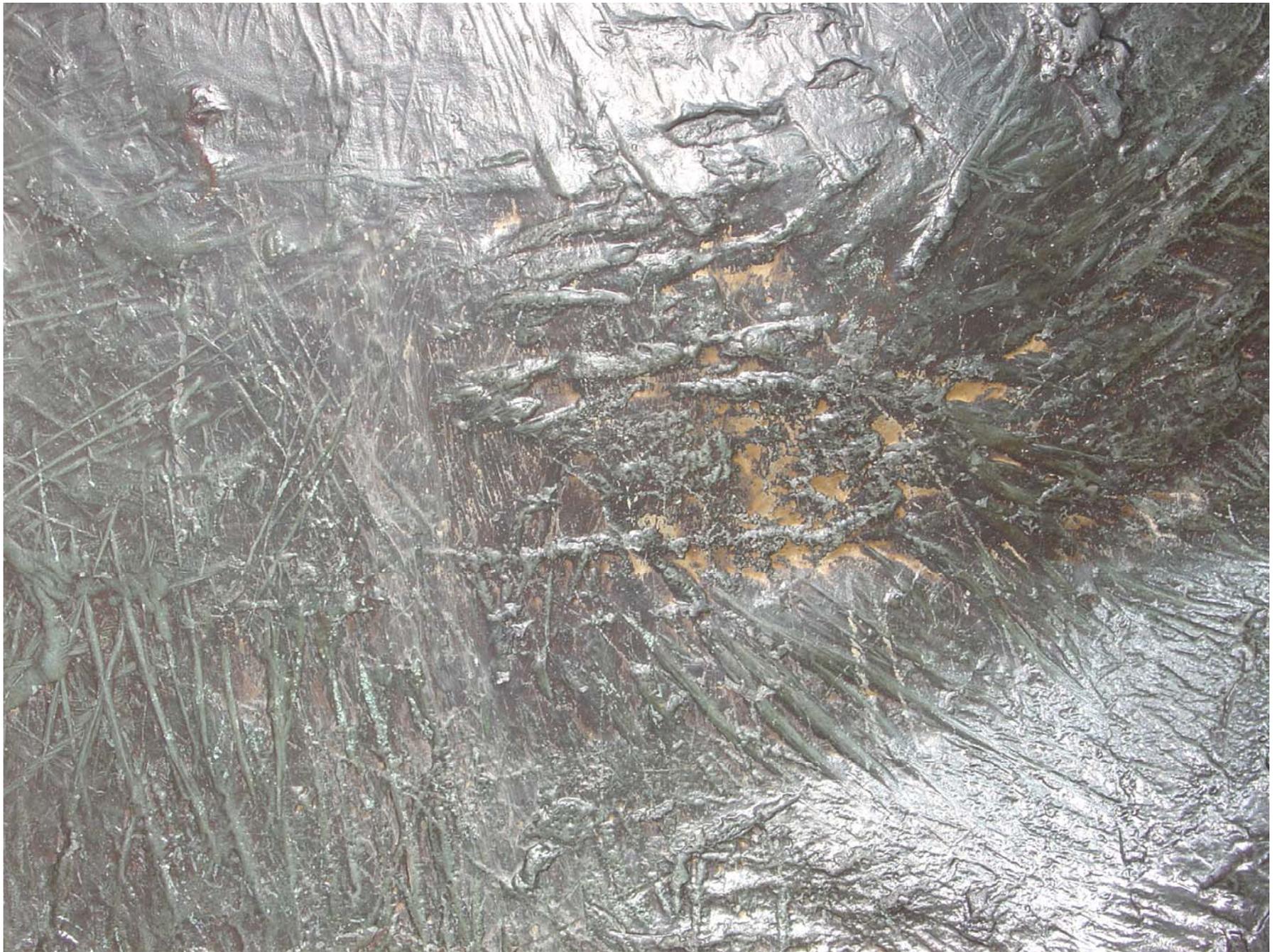
Since the mug needs to be hollow, a core must be inserted into the mug-shaped cavity, to displace volume. Above is a “core box,” used as a mold to make cores.



A finished core.



THE FOLLOWING SIX SLIDES SHOW  
VARIOUS PATINAS (NATURAL & ARTIFICIAL)  
ON BRONZE/BRASS OBJECTS AROUND  
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