MSE 445/545: Ceramic Processing

Lecture 17:
Chapter 24&25: Injection Molding and Drain/Slip Casting

• Objectives:
  – List issues for injection molding
  – List possible defects in parts from injection molding
  – List binder removal methods
  – List factors that affect springback
  – Define slip casting
  – List steps of slip casting
  – List factors that affect the slip casting speed
  – List possible defects in parts from injection molding
Injection Molding Equipment

- Injection Molding process (Fig. 24.1)
- Injection Molding Machine (Fig. 24.3)
Mode of filling and design

• **Issues**
  – Temperature control
  – Air not trapped
  – Uniform filling
  – Good separation from the mold

http://video.google.com/videosearch?q=injection+molding&hl=en&emb=0&ag=f#
Possible defects after debinding

- Fig. 24.6
Binder Removal

• Liquid flow

• Solvent Extraction

• Vaporization

• Thermal or Oxidative decomposition
Definitions: Slip/Solid/Pressure casting

- Slip casting
- Solid casting
- Pressure casting

http://www.youtube.com/watch?v=tTv4XZRQa04
Slip casting mechanics

- Shear thinning
- Viscosity: <2000mPa

\[ \tau_Y > \frac{2}{3}a(D_p - D_{slurry})g \] (eq. 25.1)

\[ L = Kt^{1/2}, \quad K = \frac{2J\Delta P K_p}{\eta R_C} \] (eq. 25.3)

- Assumption for the equation
• Factors that affect the rate

\[ L = \left[ \frac{2J\Delta P K_p}{\eta R_C} \right] t^{1/2} \]

• Draining Excess Slurry
Pressure Casting

• Why pressure?

• Disadvantage
Defects

1. Variable wall thickness
2. Shape distortion
3. Macro-cracks
4. Voids,
5. Bubbles & pinholes
6. Surface irregularity (wreathing: wave-like feature)

Reading Assignment: Ch. 26 and 27