Solving Plastic Compounding Pellet and Molding Void Problems

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Problems: void defects

- Compounding pellets
- Injection molding parts

Voids?
Root Cause Analysis

Vacuum Voids

Gas Bubbles

Voids?

Arete Materials
Identify Root Cause

- Vacuum voids or Gas bubbles?
  - Gas expands under heat (PV=nRT)!
  - Verifying test
    - Using a hot-gun to heat the void/bubble section
      - When the surface is sifting and the void/bubble expands, it is a gas bubble.
      - When the surface is sifting and the surface sinks, it is a vacuum void.
Often They are Vacuum Voids

- Forming mechanism: plastic volume change (shrinkage) from melt to solid. Too cold bath or mold causes forming a solid polymer skin but inside polymer remain hot. When the hot inside cools and shrinks, vacuum voids form.
Forming Mechanism Scheme

- In compounding strand pelletizing

- Due to low thermal conductivity, hot polymer in the center **cools and shrinks** towards the cold side!
Corrections for Vacuum Voids

- For compounding pellets
  - Increasing cooling bath temperature and optimizing cooling rate/time

- For molding parts
  - Optimizing mold temperature and cooling channels
  - Increasing packing such as packing pressure and time (but making sure that packing before the gate freezing)
  - Proper part design: wall thickness, gate locations (the thickest part of the mold is most vulnerable to vacuum voids)(thinner part less chance for voids but be aware of another defect warping)