

AN INTRODUCTION TO THE CASTING



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Current Status of Structural Materials

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INTRODUCTION

- Casting
 - Pouring Liquid (Metal) into a Mold
- History
 - Bronze Age (East Anatolia – 7000 AD)
 - First Castings (3000 AD – Mesopotamia)
 - Iron Age – (Anatolia - 1500 AD)
 - Cast Iron (500 AD – China_
 -



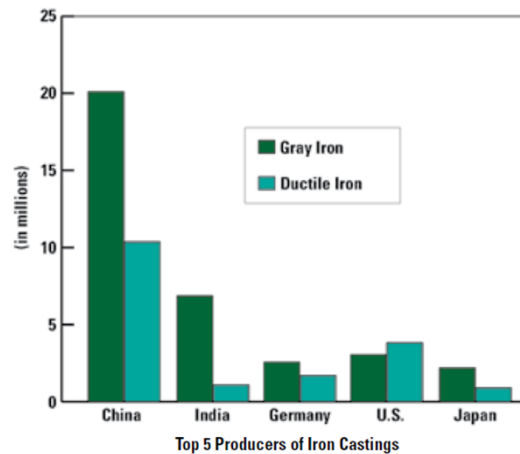
INTRODUCTION

- Total Casting Production

World Totals

Gray Iron	Ductile Iron	Malleable Iron	Steel	Copper Base	Aluminum	Magnesium	Zinc	Other Nonferrous	Total
45,870,050	24,782,540	1,381,461	10,342,738	1,799,294	13,197,181	181,931	505,614	532,313	98,593,122

GRAY IRON VS. DUCTILE IRON



Casting Steps

- a) Design (Running, Feeding Systems)
- b) Molding
- c) Melt Preparation (Composition, Melt Quality, Degassing, Inoculation, ...)
- d) Mold Filling (Gating, Casting, and Feeders)
- e) Cooling and Solidification
- f) Cutting Gating and Feeding Systems
- g) NDT and DT
- h) Heat Treatment
- i) Machining



Pros & Cons

A person wearing a dark protective suit and helmet is seen from behind, standing in a dark industrial environment. The scene is illuminated by a bright orange glow, likely from molten metal, with numerous sparks or particles floating in the air. The background shows industrial structures and equipment.

1. Manufacturing of Complicated Geometries
2. Internal and External Surfaces
3. Net Shape (Investment Casting) or Near Net Shape Casting
4. Very Light (few grams) to Super Heavy Parts (More than 500,000 kg)
5. Mass Production

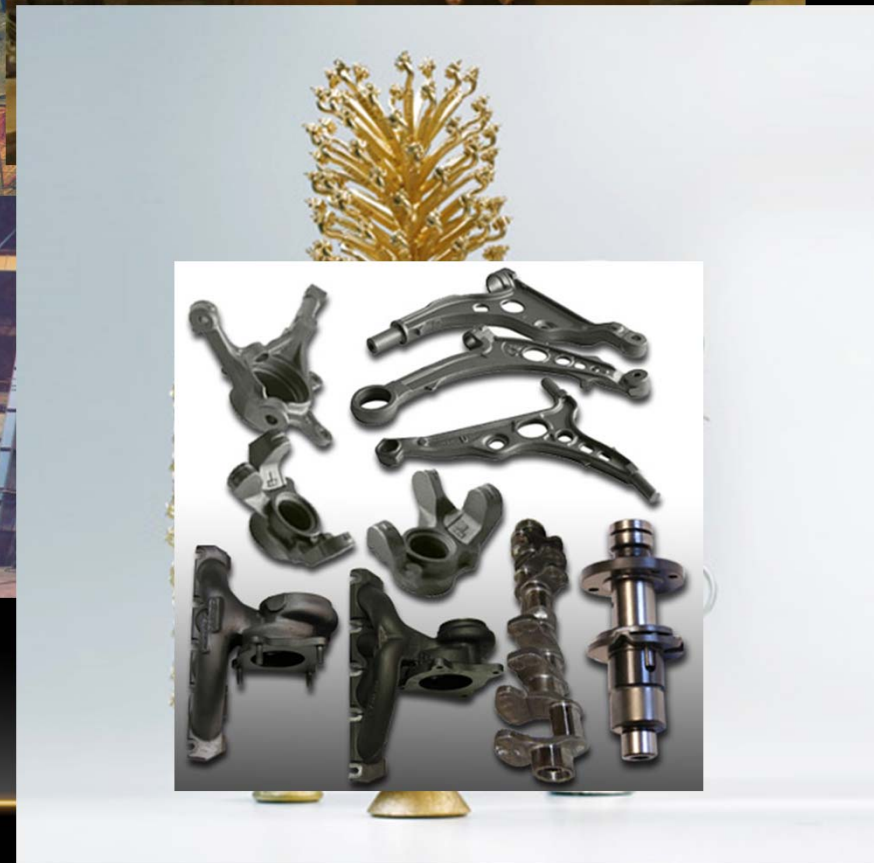
1. Low Mechanical Properties due to Several Defects

- Gas and Shrinkage Porosities
- Segregation
- Oxide, Inclusions and Bubble Entrainment

2. Low Surface Quality (General Castings)
3. Ecological Dangers
4. Safety Problems

Classification of Castings by Weight

- Heavy Castings: Roll Castings,
 - Steel or Cast Iron Pipes for Oil or Gas Pipelines (56" or more), Bells, Cement Mill Ring
- Average Weigh Casting :Automotive Parts
- Fine Parts: Jewelry

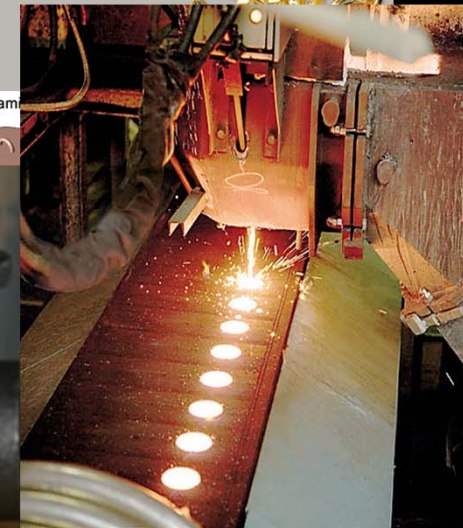
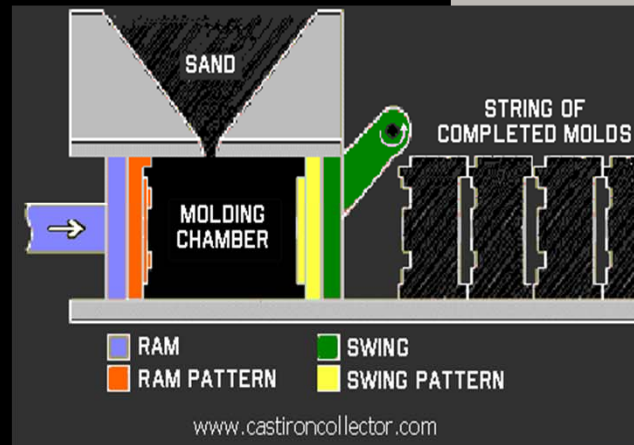
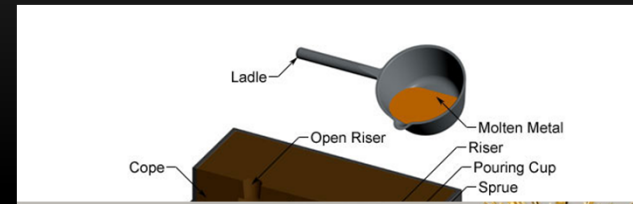


Casting Classification

- Expandable Mold
 - Sand Molds
 - Investment
 - Shell Mold
 - Loss Foam
 - Disamatic
- Permanent Mold
 - Gravity Die
 - High Pressure Die
 - Low Pressure Die
 - Squeeze
- Continuous Casting
 - Horizontal
 - Vertical
 - Strip Casting

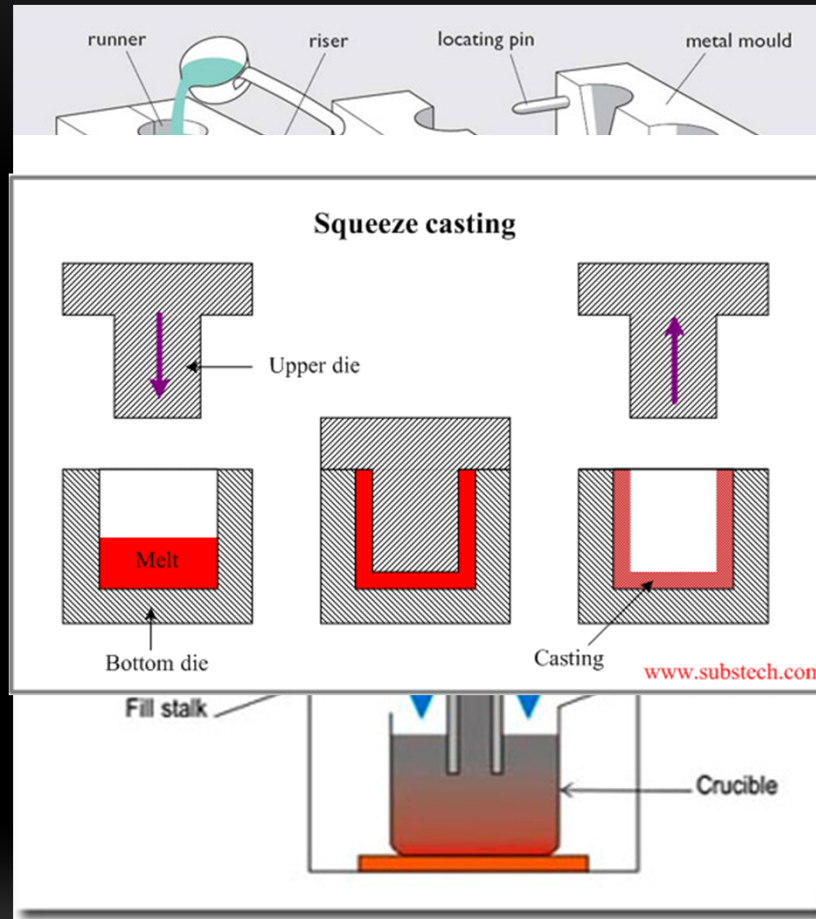
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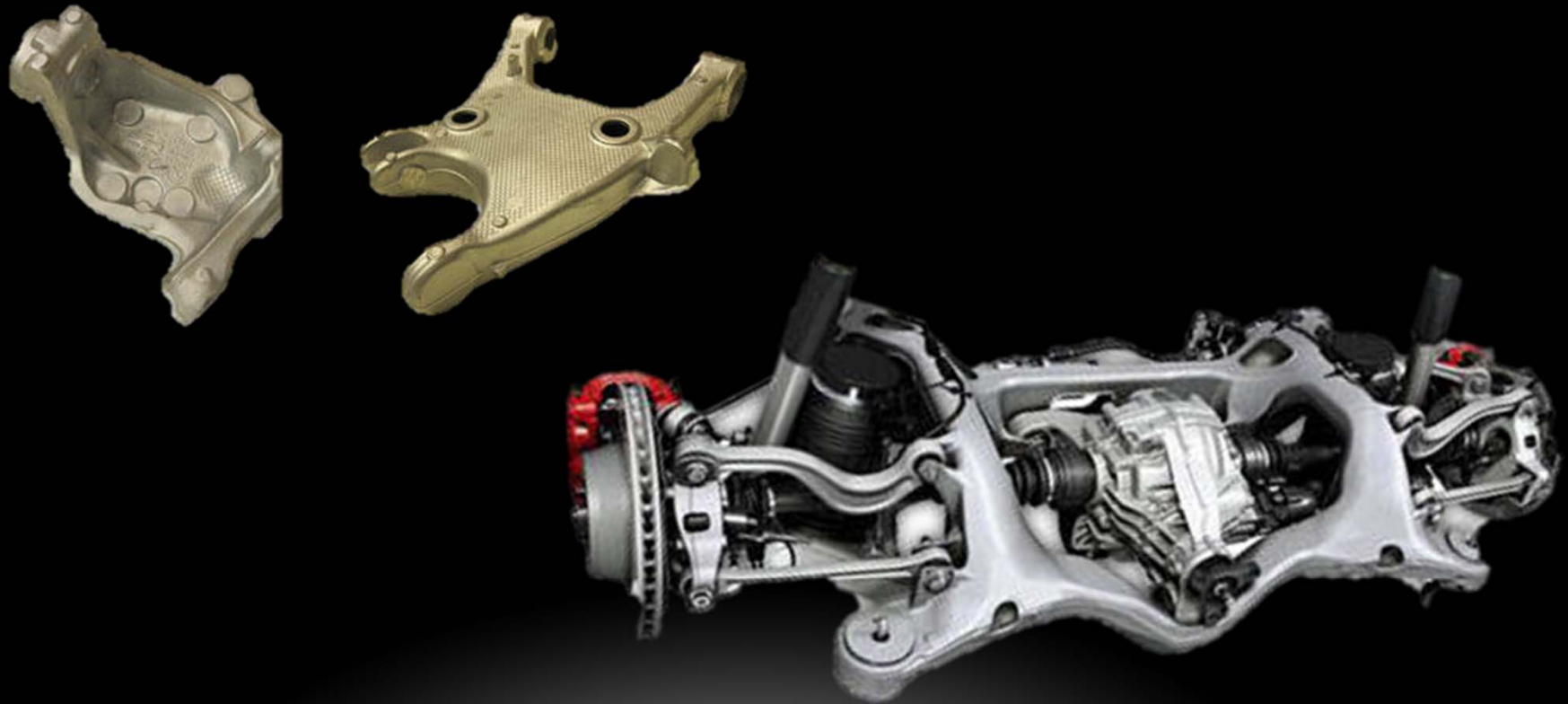
Casting Classification

- Permanent Mold
 - Gravity Die
 - High Pressure Die
 - Low Pressure Die
 - Squeeze



Low Pressure Die Casting

- Porsche Panorama



www.sutcast.com

www.fac.no

Strip Casting

- Horizontal Strip Casting
- Vertical Strip Casting
- Semi-Solid Casting
- Differential Roll Speed Strip Casting

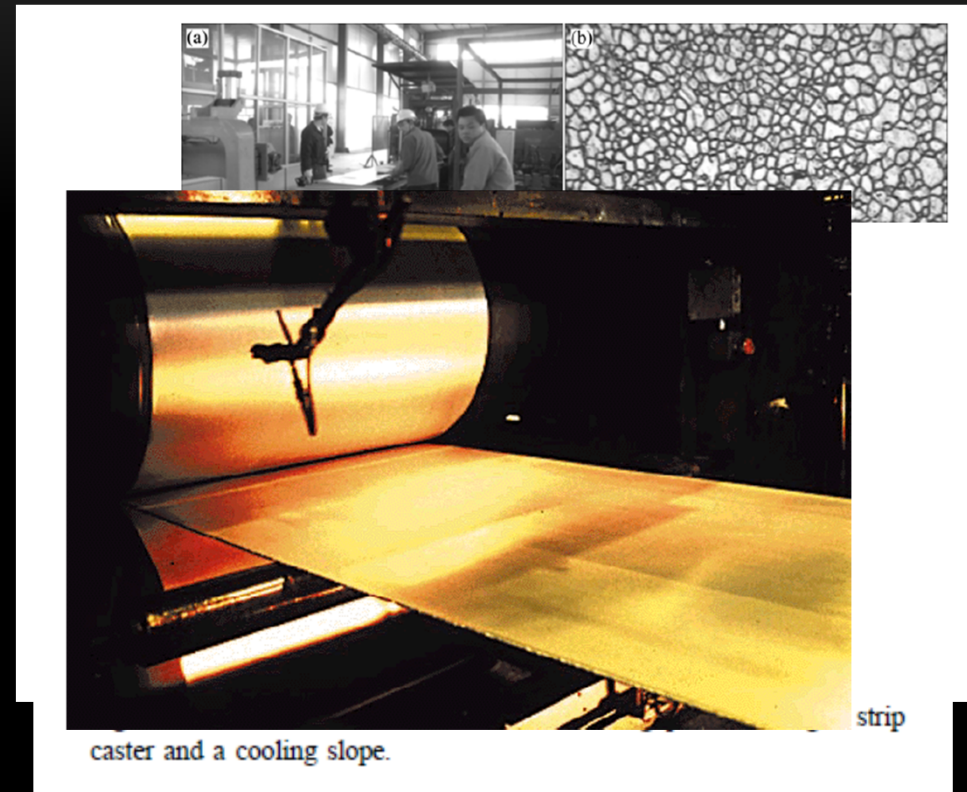
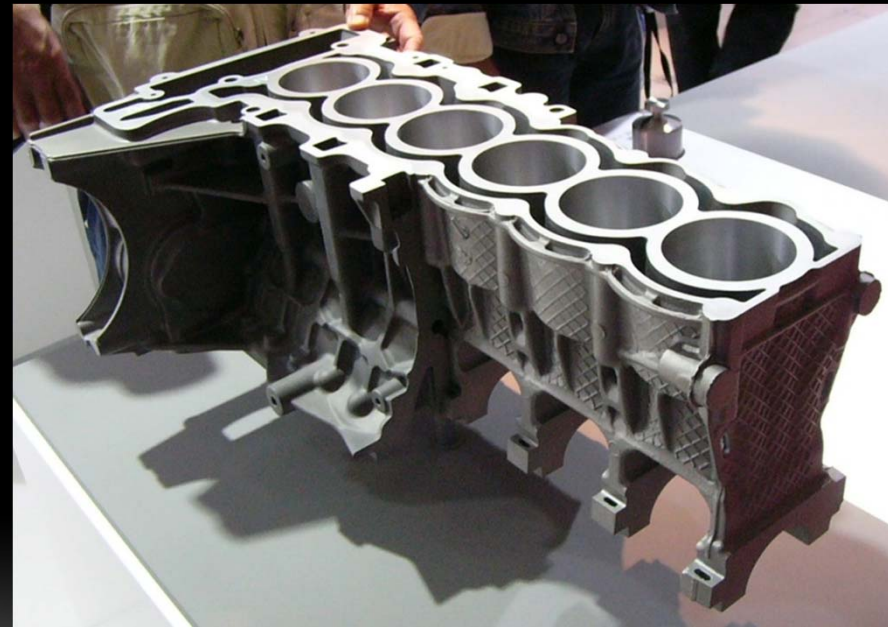


Fig. 2. Schematic illustration unequal diameter twin roll caster

T.Haga-JAMME-Vol. 14- Al Alloy SemiSolid Strip Casting using an Unequal Dia. TRC, 2006.
G. Sh. W - Tr. Nonf. Met. Soc. Ch. - Vol. 20 - pp. 973-979 - Preparation of AZ31 Mg Alloy Strips
Using Vertical TRC, 2010

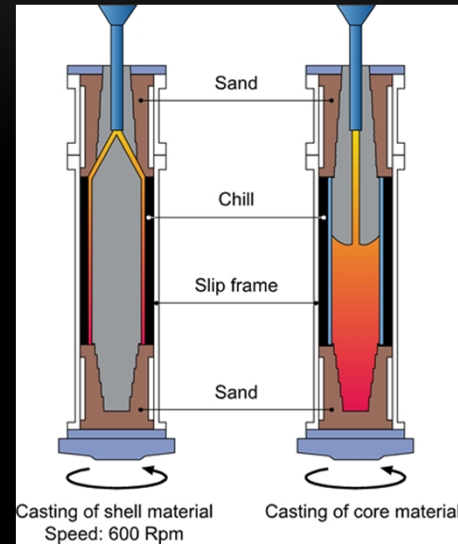
Bi-metals Casting

- Cylinder Block of BMW
- Combination of Welding and Casting
- Aluminum + Magnesium



Bi-Structures Casting

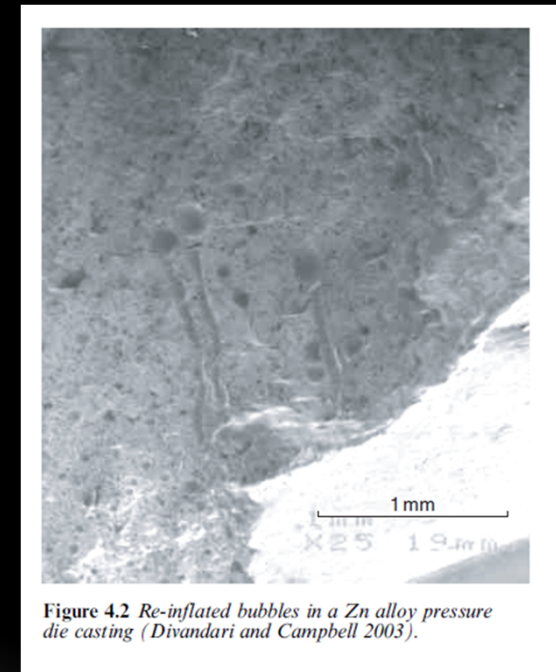
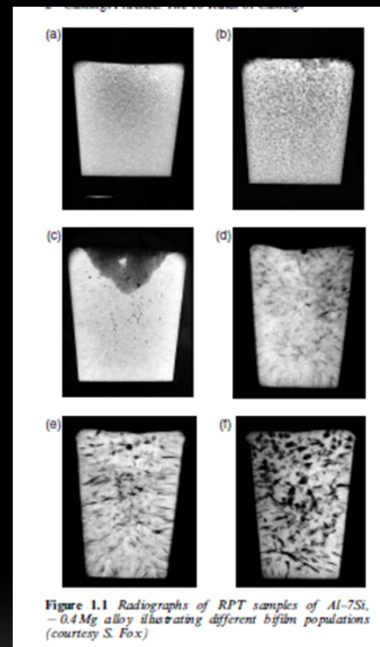
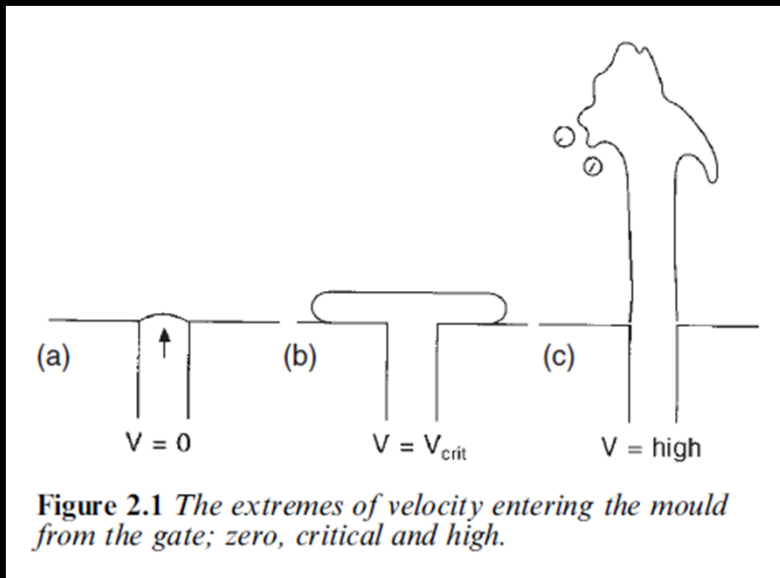
- Centrifugal Casting
- Chilled Casting



<http://www.youtube.com/watch?v=4cyzzFjzr7I>

Double Oxide Films

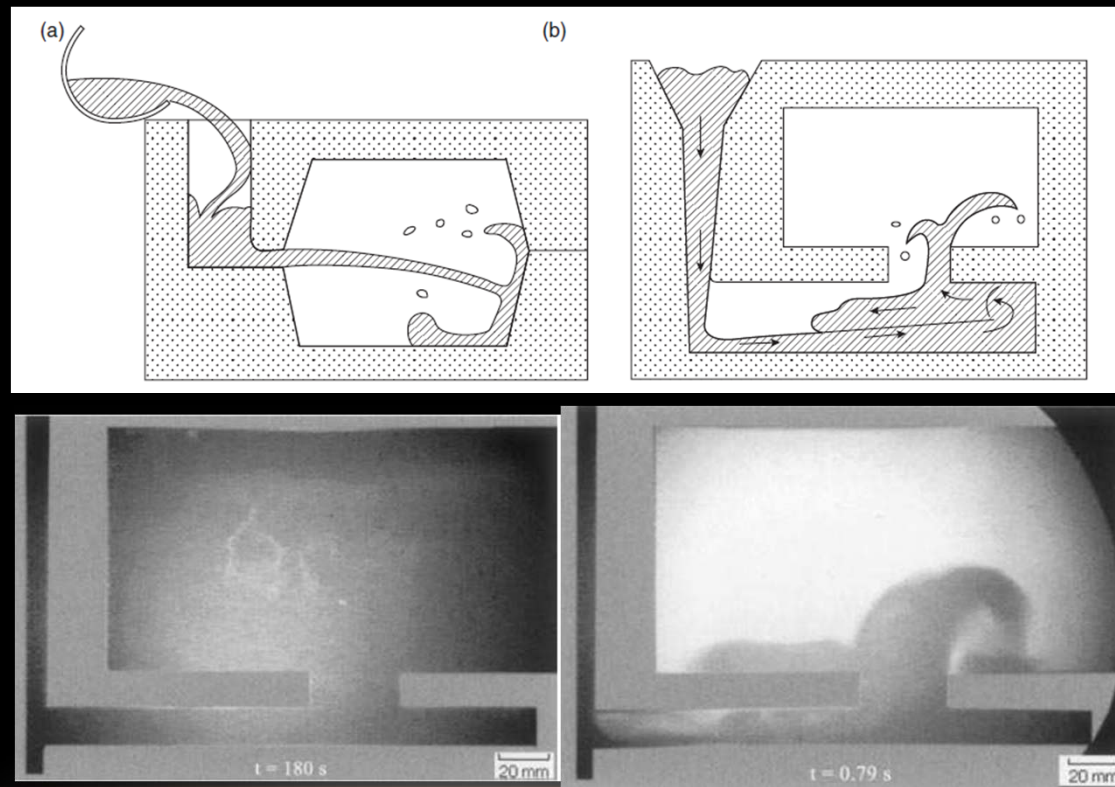
- Critical Velocity Concept
- Effects of Melt Quality on Defects Formation



- J. Campbell, Castings Practice: 10 Rules of Castings, 2004

Double Oxide Films

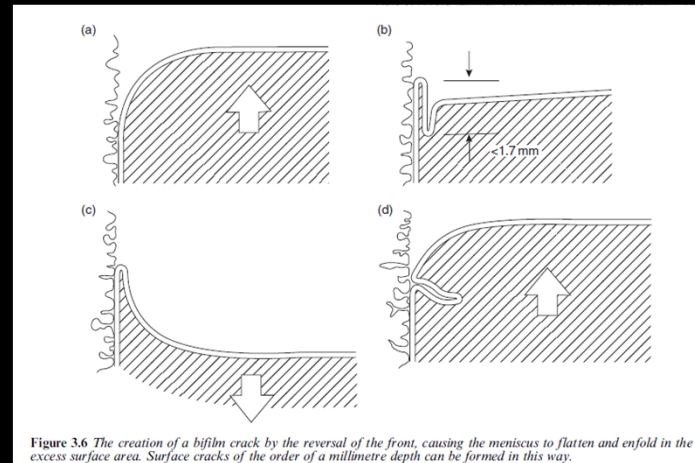
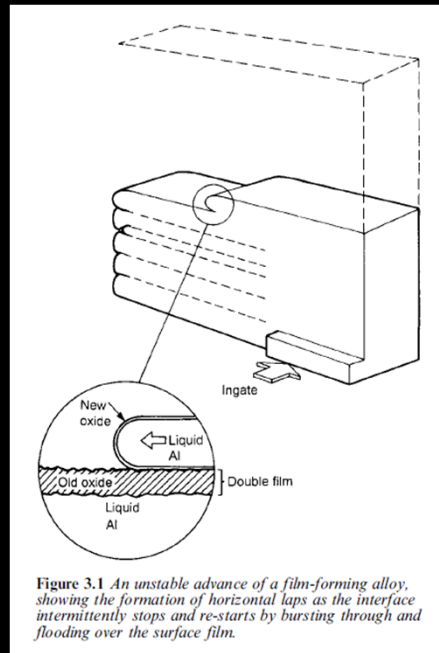
- Pressurized and Non Pressurized Systems



- J. Campbell, Castings Practice: 10 Rules of Castings, 2004

Double Oxide Films (Bi-films)

- Different Conditions of Formation



- J. Campbell, Castings Practice: 10 Rules of Castings, 2004

A photograph of molten metal being poured from a ladle into a mold in a dark industrial setting. The scene is illuminated by the intense orange and yellow glow of the molten metal, which is cascading down the sides of the mold. The background is dark, with some industrial structures and a staircase visible on the left side. The overall atmosphere is one of intense heat and industrial activity.

Specially Thanks
for
Attention