ADI
AUSTEMPERED DUCTILE IRON
Abhisheek Alloys Pvt Ltd;
Belgaum, INDIA.
What Is the Austempering Process?

- A high performance heat treatment that imparts superior properties to ferrous materials.
- A material that can be ~3x’s the yield strength of the highest strength as-cast ductile iron?
- A material that can be made lighter than aluminum with the same/greater strength?
- A material Lower in cost than aluminum, steel, and steel forgings?
What Does Abhishek Alloys Austemper Facility Do?

- Austempered Ductile Iron (ADI)
- Austempered Gray Iron (AGI)
- Austempered Steel
- Carbo-Austempered™ Steel
- Carbidic Austempered Ductile Iron (CADI)
## ASTM Ductile Iron Specifications

<table>
<thead>
<tr>
<th>Grade</th>
<th>Tensile Strength (MPa / Ksi)</th>
<th>Yield Strength (MPa / Ksi)</th>
<th>Elongation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-40-18</td>
<td>414 / 60</td>
<td>276 / 40</td>
<td>11</td>
</tr>
<tr>
<td>65-45-12</td>
<td>448 / 65</td>
<td>310 / 45</td>
<td>12</td>
</tr>
<tr>
<td>80-55-06</td>
<td>552 / 80</td>
<td>379 / 55</td>
<td>6</td>
</tr>
<tr>
<td>100-70-03</td>
<td>689 / 100</td>
<td>483 / 70</td>
<td>3</td>
</tr>
<tr>
<td>120-90-02</td>
<td>827 / 120</td>
<td>621 / 90</td>
<td>2</td>
</tr>
</tbody>
</table>
ADI starts with High Quality Ductile Iron

Consistent Pearlite Ferrite Ratio
What is High Quality Ductile Iron?

- Consistent Chemistry
- Consistent Pearlite/ferrite Ratio
- 100+ nodules/mm² minimum
- 90%+ Nodularity
- < 0.5% carbides & inclusions
- < 1% porosity and/or micro shrinkage
ADI is...

...heat treated by the Austempering process resulting in a matrix of acicular ferrite and carbon stabilized austenite, better known as “Ausferrite”.

The Austemper Heat Treat Process
This schematic diagram illustrates the various phases of the ADI heat treat cycle.
ADI Microstructures

- Grade 1 ADI
- Grade 5 ADI
ADI ...

...has a **strength-to-weight ratio** higher than aluminum and is used to replace steel and aluminum castings, weldments and forgings.
How Does ADI Compare to Steel and Aluminum?

Steel
- ADI Costs 20% less than steel
- ADI is 10% less dense than steel
- ADI has Improved Noise Damping
- ADI has improved Machinability

Aluminum
- ADI has a Minimum 30% cost savings
- ADI is 3 Times Stronger
- ADI is 2.3Times Stiffer
- ADI has improved Fatigue strength
- ADI has Better Wear resistance
Relative Machinability of Various Materials

- 65-45-12 Ductile Iron
- AISI 1110 Free Machining Steel
- 80-55-06 Ductile Iron
- 110-70-11 ADI
- 100-70-03 Ductile Iron
- 125-80-10 ADI
- AISI 4140 Steel at Rc30
What does ADI have to Offer for the end-user?

- High strength-to-weight ratio
  - Can replace aluminum pound for pound.
- Good wear resistance
  - (Transformation to martensite during field use)
- Good fatigue strength
- Good manufacturability
  - Nearer net shape than forgings or weldments
  - Excellent as-cast machinability
- Low product cost
- Less cost than comparable steel or aluminum components
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