Fe-C phase diagram

- \( \gamma \) = Austenite
- \( \alpha \) = Ferrite
- \( \delta \) = Delta iron
- \( \text{CM} \) = Cementite

Temperature

CM begins to solidify
Primary austenite begins to solidify
Austenite in liquid
Austenite solid solution of carbon in gamma iron

2066\(^\circ\) F

Austenite and pearlite
Cementite and transformed ledeburite
Magnetic change of Fe\(_3\)C

2.4%
6.67%
4%
8%
16%
3%

Hyper-eutectoid
Steel
Hypo-eutectoid

3.0%
0.8%
1.9%

A + L
A
**Steel C, Grain Size 8, Established at 1830°F**

**TRANSFORMATION TIME-SECONDS**

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**RAIL STEEL**

<table>
<thead>
<tr>
<th>Element</th>
<th>Composition</th>
</tr>
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<tbody>
<tr>
<td>C</td>
<td>0.79</td>
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<tr>
<td>Mn</td>
<td>0.76</td>
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<tr>
<td>P</td>
<td>0.026</td>
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<tr>
<td>S</td>
<td>0.030</td>
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<tr>
<td>Si</td>
<td>0.21</td>
</tr>
</tbody>
</table>

**Austenitizing Temperatures**: As indicated on curves.

**Grain Size**: As indicated beneath curves.

- **Anneal 1**: Coarse pearlite (10) 900°C - 30 mins
- **Anneal 2**: Fine pearlite
- **Anneal 3**: Bainite 250°C - 15 mins
- **Anneal 4**: Martensite (10) Water quenching
- **Anneal 5**: Tempered (10) - (20) 850°C - 30 mins