Roll Manufacturing Processing

Material grades for your mill

Fall 2018 IRD

LEADAR ROLL

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Conventional - Common Methods of Roll Making

Cast Iron

- Static Cast Or Single Pour *(All With same Alloy)*
- Centrifugal Cast Or Double Pour *(Outer Shell Alloy – Higher Ni-Cr-Mo Inner Core – Promote Better Machinability; Less Expensive Alloy)*

Cast Steel

- Static Cast
- Centrifugal Cast

☆☆ Roll Design Has To Select The Best Method To Use In Supplying Mill Rolls. ☆☆

Considerations

- Stands Where Used – Rougher – Intermediate – Finisher
- Pass Depths – Type
- New to Scrap Size *(Especially if Centrifugally Cast is Used)*

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Importance of Microstructure in Cast Rolls

Increasing Alloy – Changed Microstructures

Examples

- Lower All – Pearlite – Range Hardness 620-700 Ld
- Alloy – Rougher – Intermediate 52-65 HSc

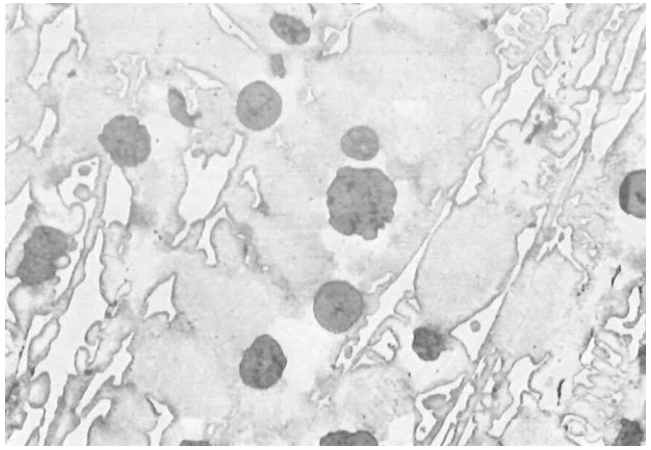

Fig 1 Surface Layer SG-P 2%Ni Magnification 200x

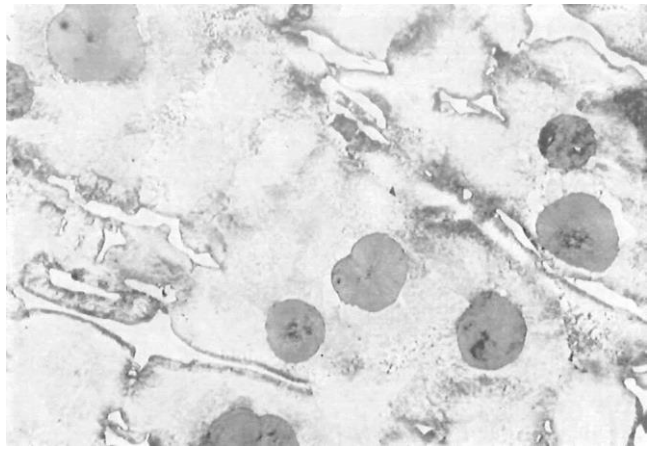

Fig 2 Beneath Barrel SG-P 2%Ni Magnification 200x

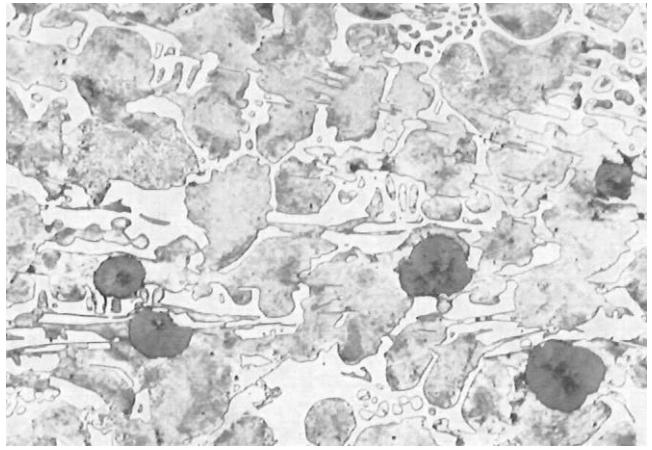

Fig 3 Surface Layer SG-P 3%Ni Magnification 200x

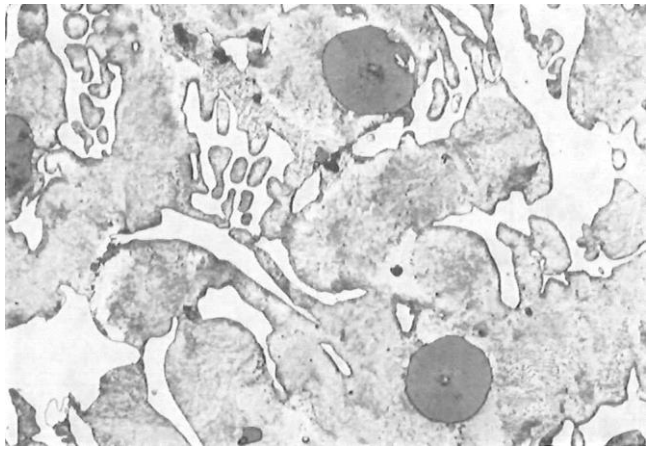

Fig 4 Beneath Barrel SG-P 3%Ni Magnification 200x

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Importance of Microstructure in Cast Rolls

Higher Alloy – Changes the Microstructures

Examples

- Pearlite / Beanite / Martensite (Needle Like)

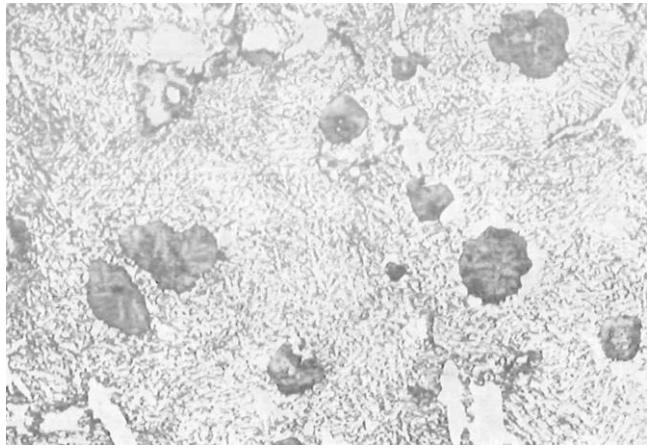

Fig 1 Surface Layer SG-P 3%Ni Magnification 200x

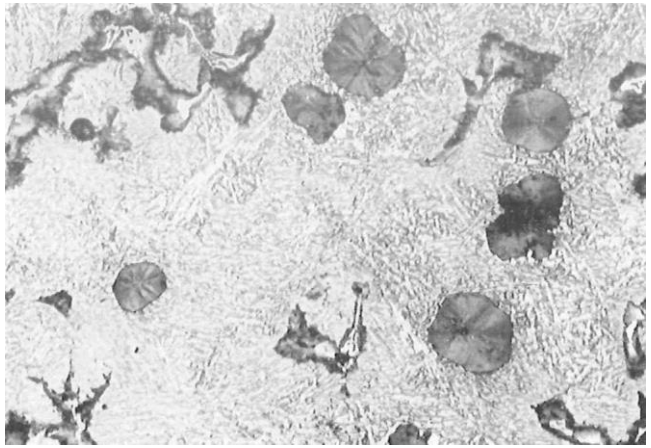

Fig 2 Beneath Barrel SG-P 3%Ni Magnification 200x

Fig 3 Surface Layer SG-P >3%Ni Magnification 200x

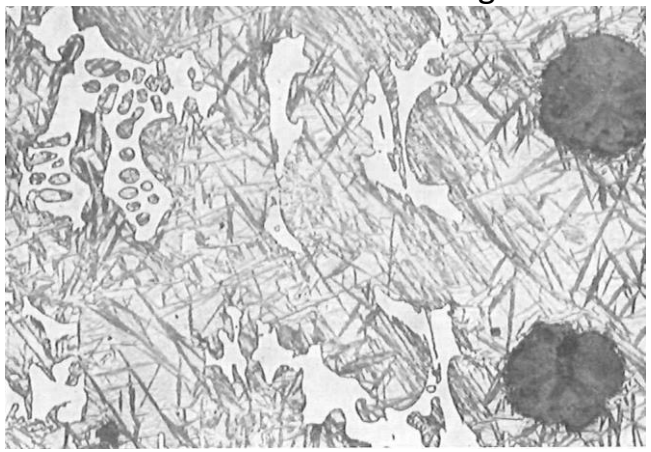

Fig 4 Beneath Barrel SG-P >3%Ni Magnification 200x

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Importance of Microstructure in Cast Rolls

Normalized – Heat Treated

- Good Application : Recommended Where Both Strength and Ability to Withstand Thermal Shocks are Paramount
- Exceptionally Good Mechanical Properties
- Higher Cost Due to Added Heat Treating

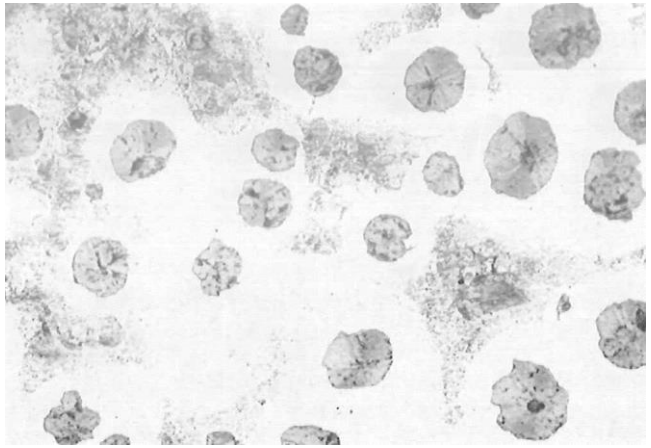

Fig 1 Surface Layer Lower Alloy Heat Treated Mag. 200x

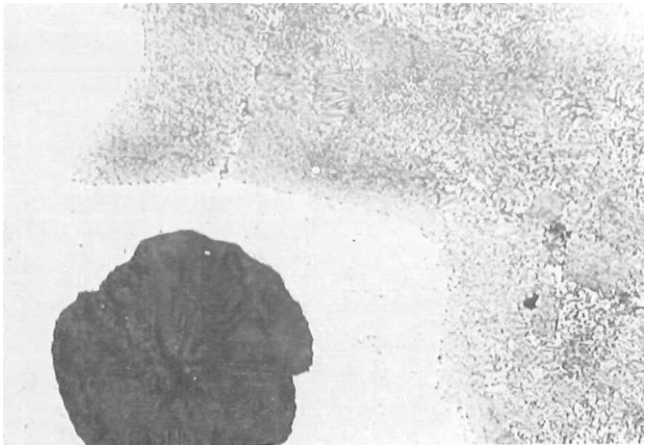

Fig 2 Beneath Barrel Lower Alloy Heat Treated Mag. 500x

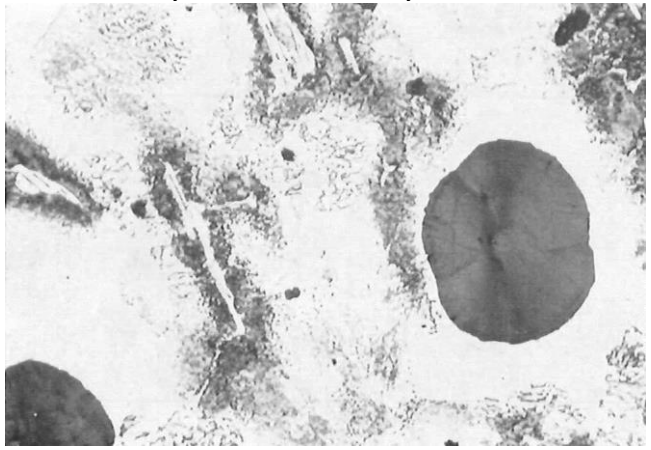

Fig 3 Surface Layer Higher Alloy Heat Treated Mag. 500x

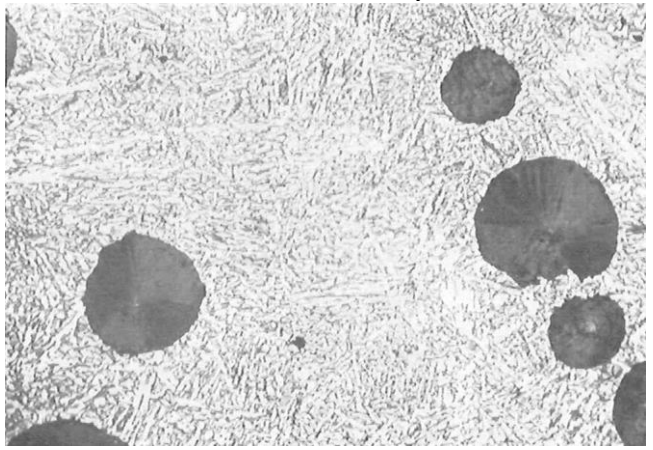

Fig 4 Beneath Barrel Higher Alloy Heat Treated Mag. 500x

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Coreless Induction Furnace used in Cast Roll Melting

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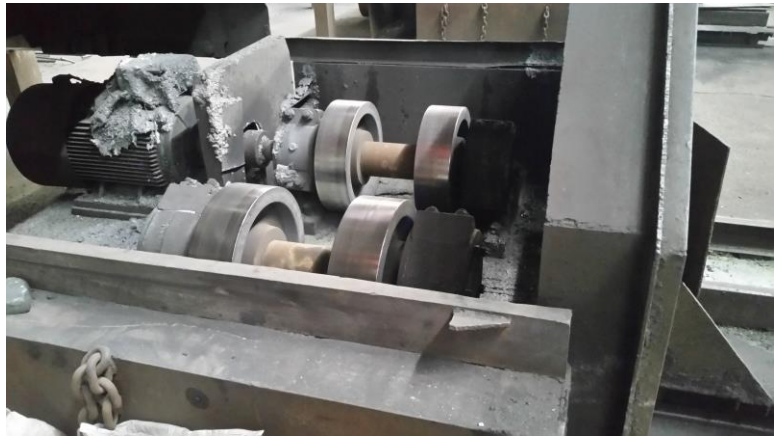
Tapping & Pouring

Centrifugally Cast



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Cast Rolls Cooling After Pour

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When Demand Exceeds Conventional Cast Rolls

Composite Bonded Powder Metal Rolls Take Over

Application:

- Intermediates to Finishers

Advantages:

- Greater Pass Life In Multiples
- Holds Shape Longer
- Many Alloy Options - 1V - 3V - 9V - 10V - High Speed Bridge Alloy
- Improved Surface Quality Due to Fine Grain Size and Uniform Carbide Distribution
- U.S.A. Made

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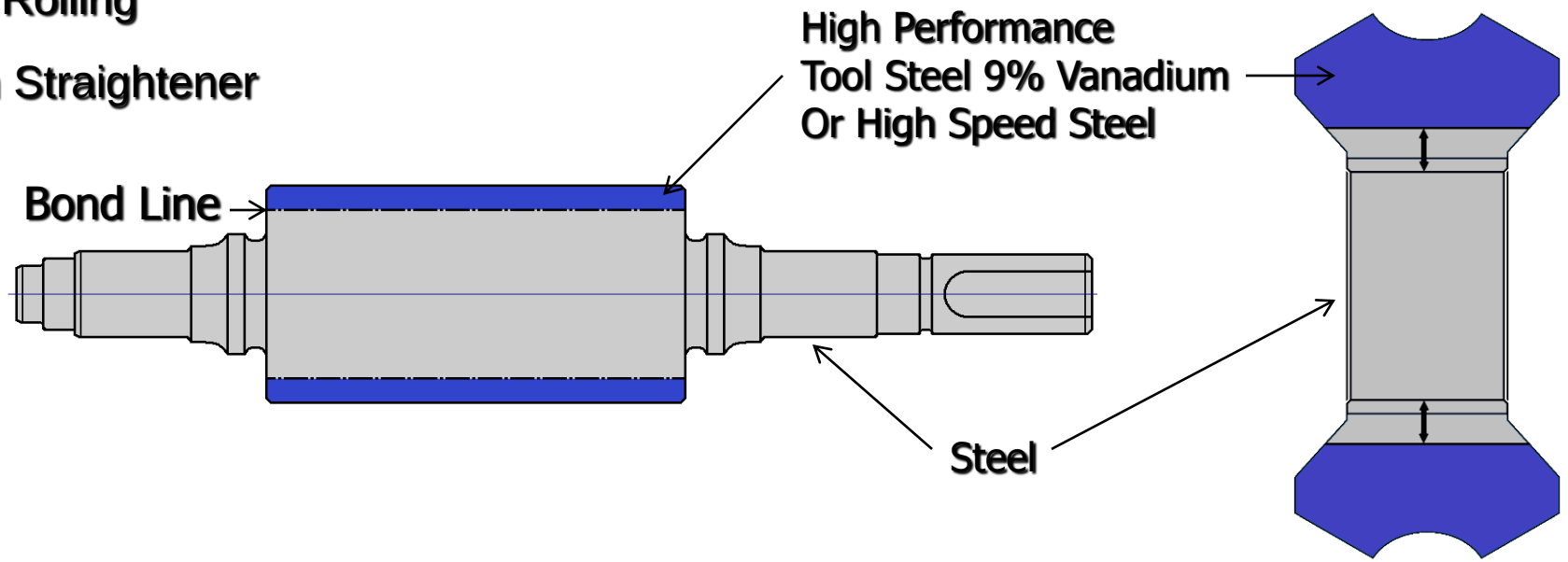
Composite Bonded Roll (CPM 9V)

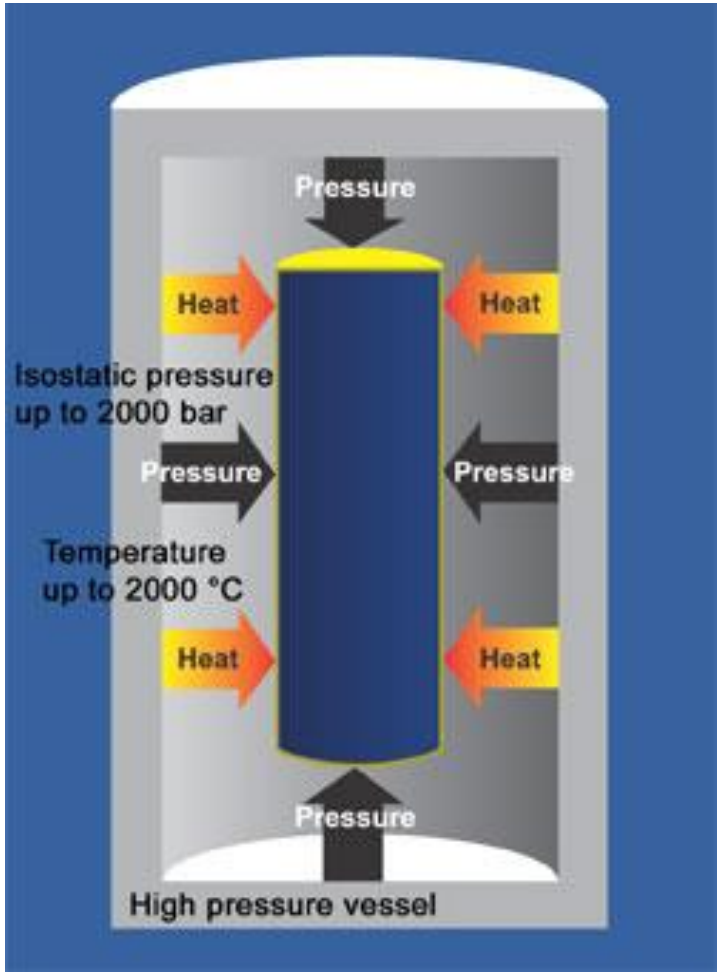
Two piece construction

- Outer Surface Roll is Powder Metal High Speed Steel
- Inner Roll is a Medium Grade 4140 Alloy Steel or Carbon Steel
- Metallurgically Bonded at Bond Line Composite Steels
- Applications :
  - Hot Rolling
  - Cold Rolling
  - Form Straightener



Composite Bonded Roll (CPM 9V)

Hot Isostatic Pressing



Composite Bonded Roll (CPM 9V)

CBR™ Tool Steel Microstructure

9% Vanadium

2% Carbon

500 x

1000 x

Powder Metal Characteristics:

- Uniform Fine Grain
- Rounded Carbides in Microstructure
- Excellent Wear Resistance and Toughness
- Resistant to Mechanical Abrasion

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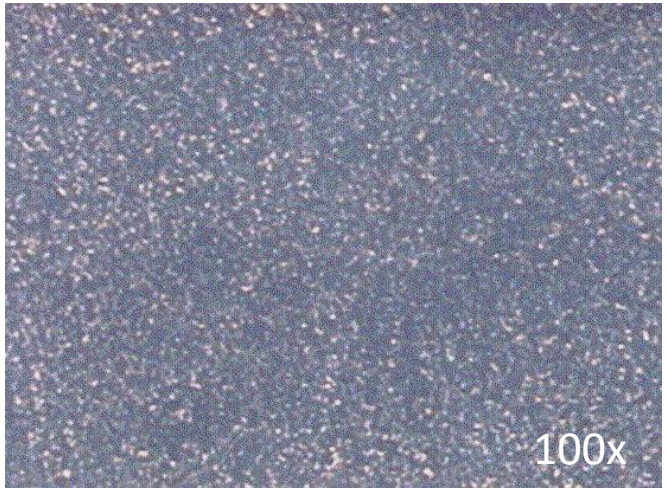
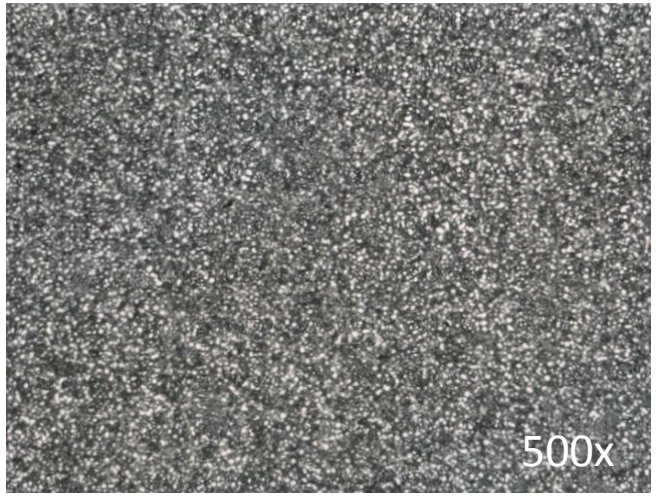
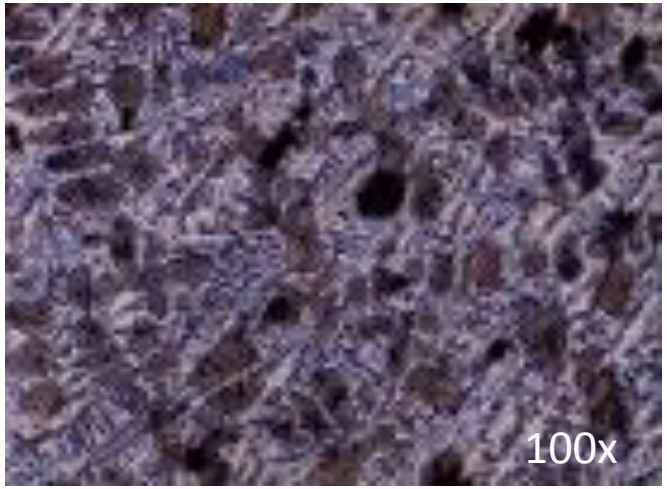
Microphotographs



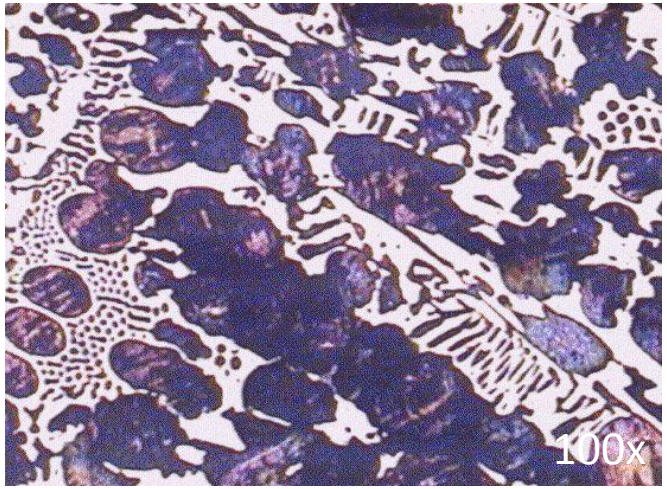
PM 9V



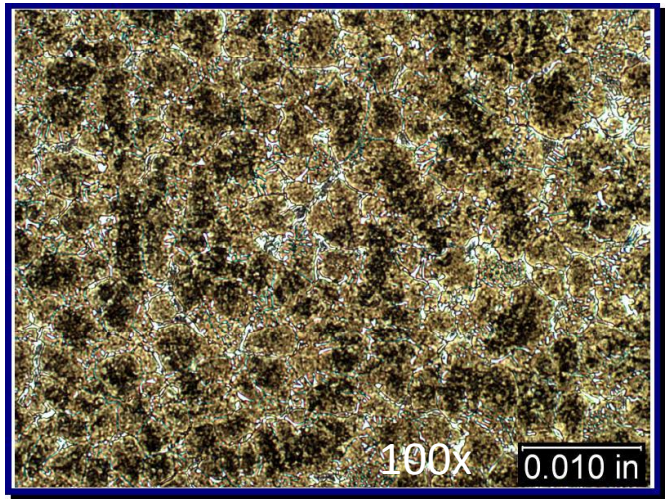
PM 9V @500x



Nodular Iron



Heat Treated High Chrome

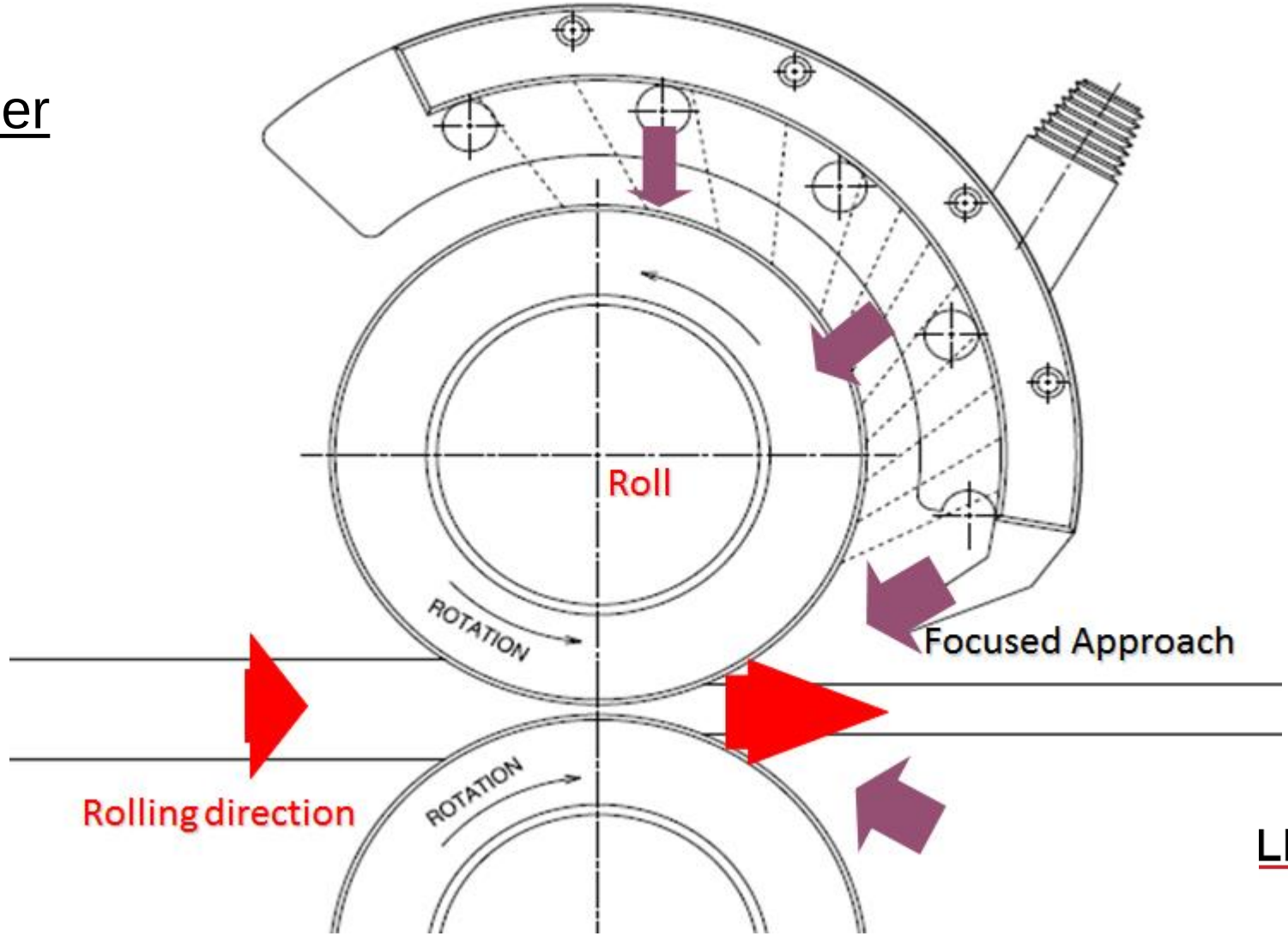


Bi-metal ForMax

Cooling System

Factors to Consider

- Volume
- Pressure
- Quantity
- Temperature



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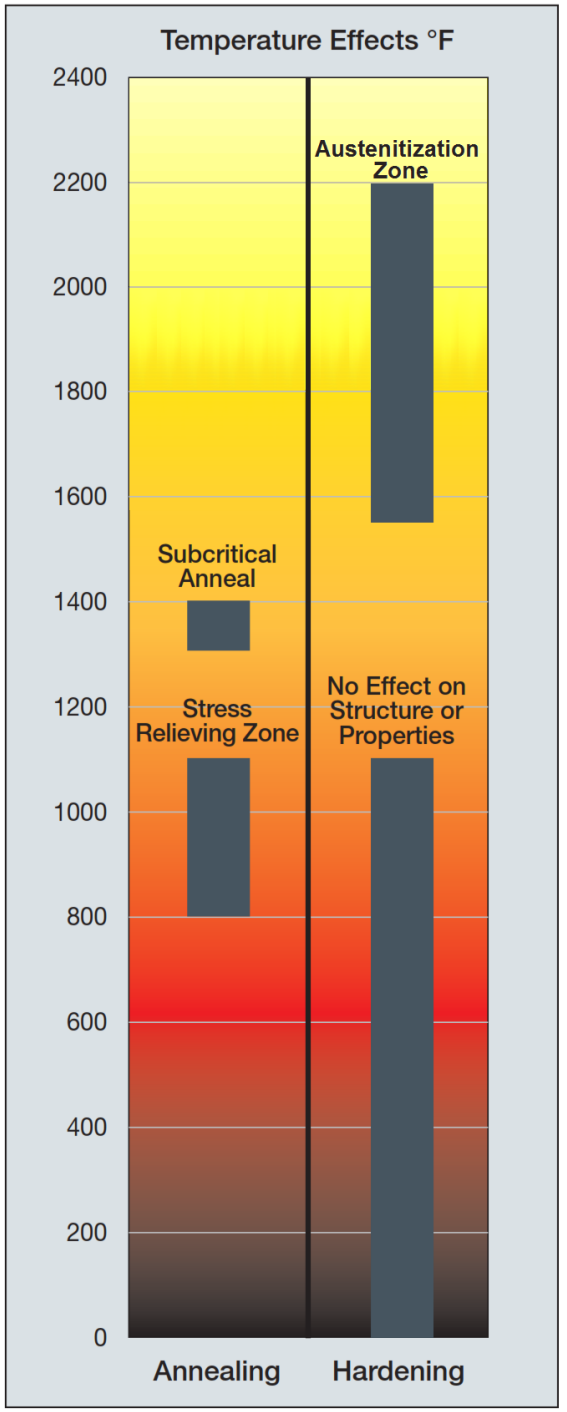
Temperature Effects

Overheating Rolls Can Degrade The Microstructure And Have Harmful Effects



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Investigation of Roll Damage During Rolling

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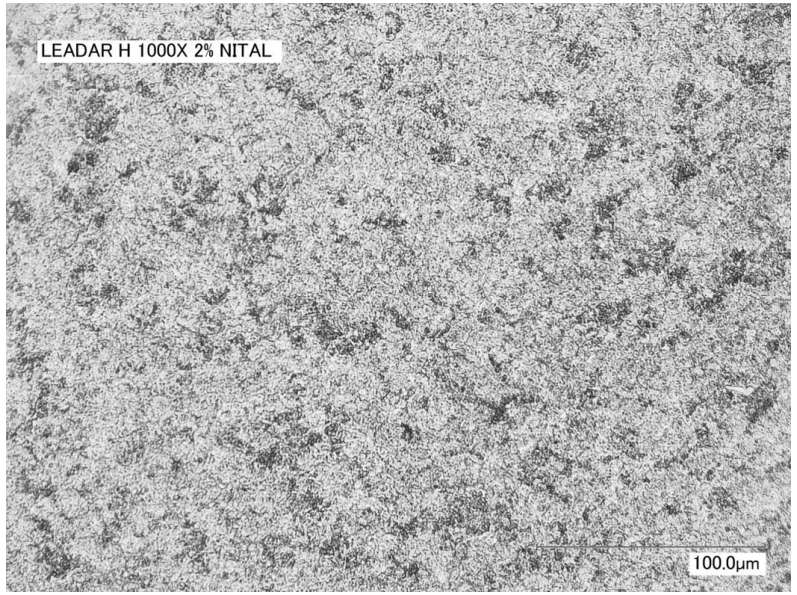
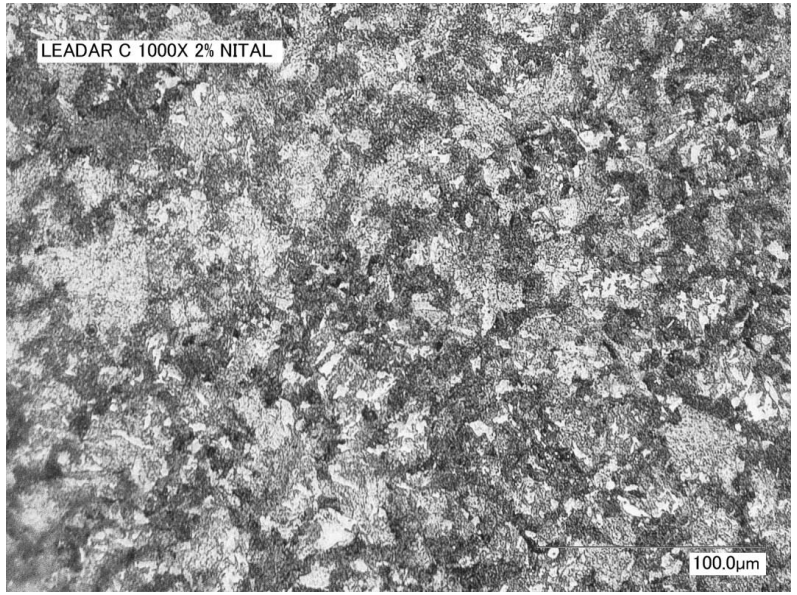
Investigation of Roll Damage

New Developments – Forged High Performance Roll



- Micrograph shows extremely fine-grained structure of tempered martensite
- Fine carbide dispersion approximately 25% carbide
- Structure is completely wrought
- No evidence of residual dendritic structure or porosity as would be present in a cast roll
- Surface hardness 63 HRc to provide roll wear resistance



- Core microstructure shows fine-grained structure of tempered martensite
- Structure is completely wrought
- No evidence of residual dendritic structure or porosity as would be present in a cast roll
- Core hardness of 30 HRc to provide roll toughness

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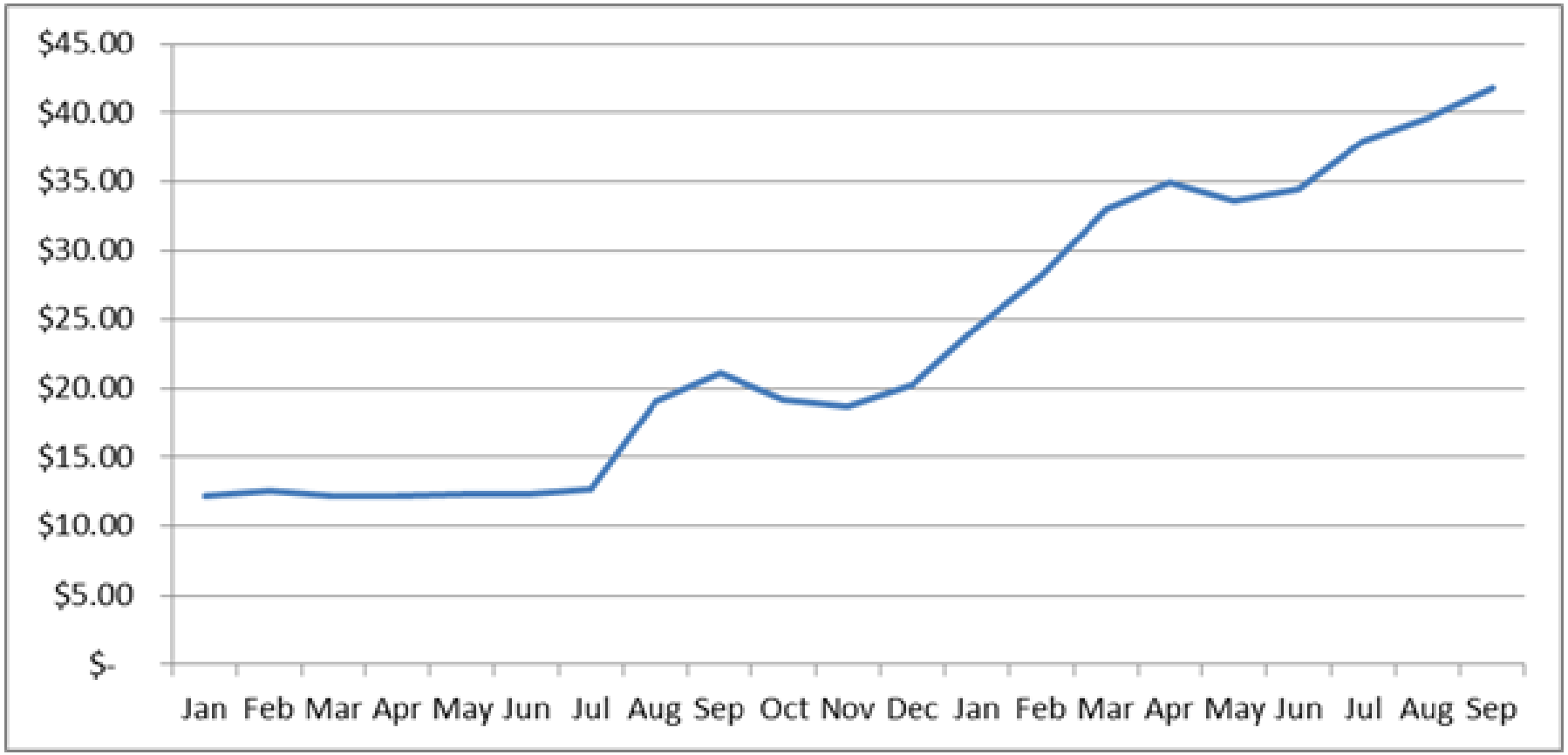
Alloy Price Curve



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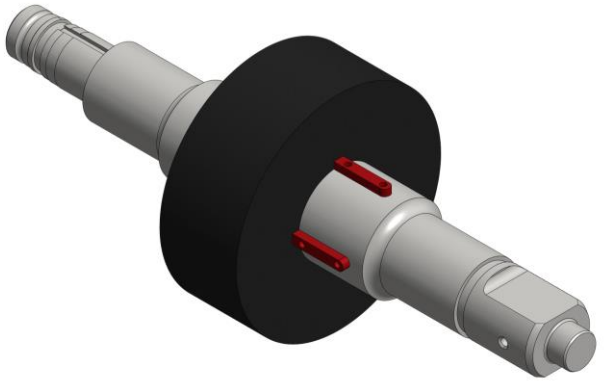
Questions

Engineered Solutions



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