Graphite Growth and CGI Process Control Requirements

SinterCast
Supermetal CGI

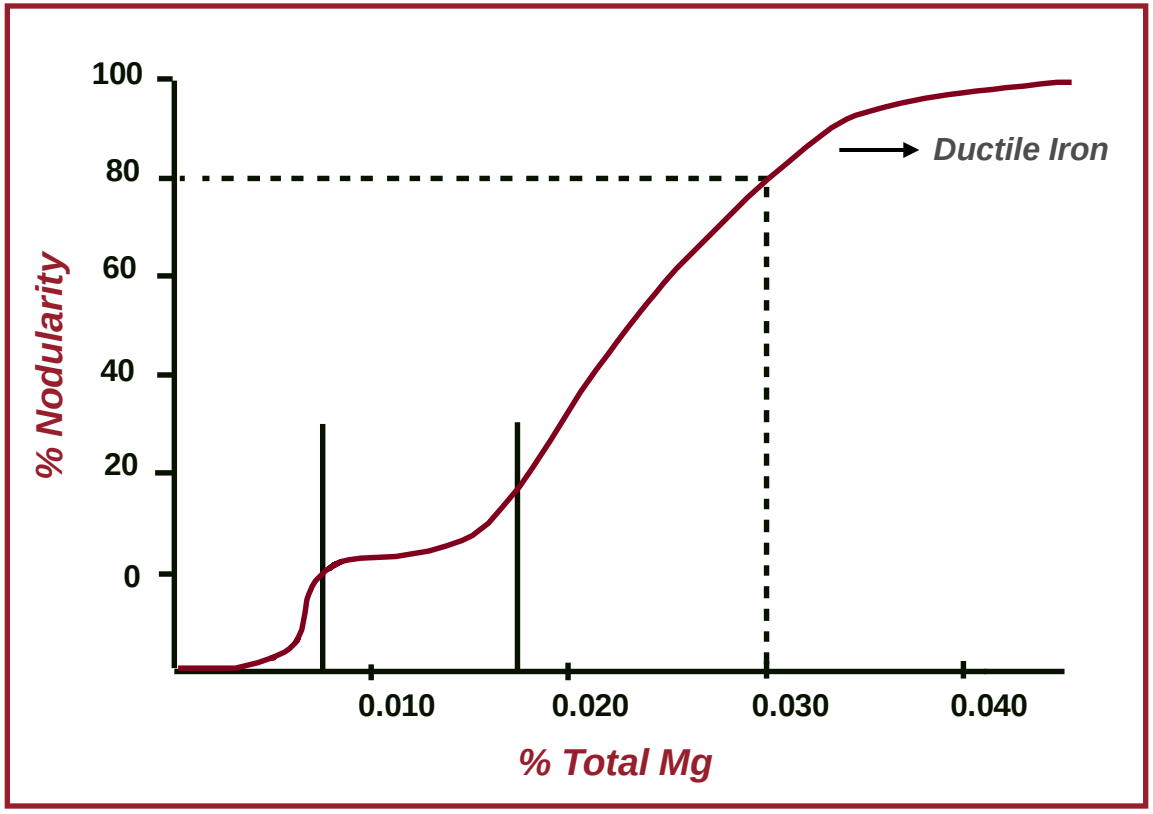
CGI Process Control

Magnesium

Inoculant

Cooling Rate

Shrinkage



SinterCast
Supermetal CGI

CGI Process Control

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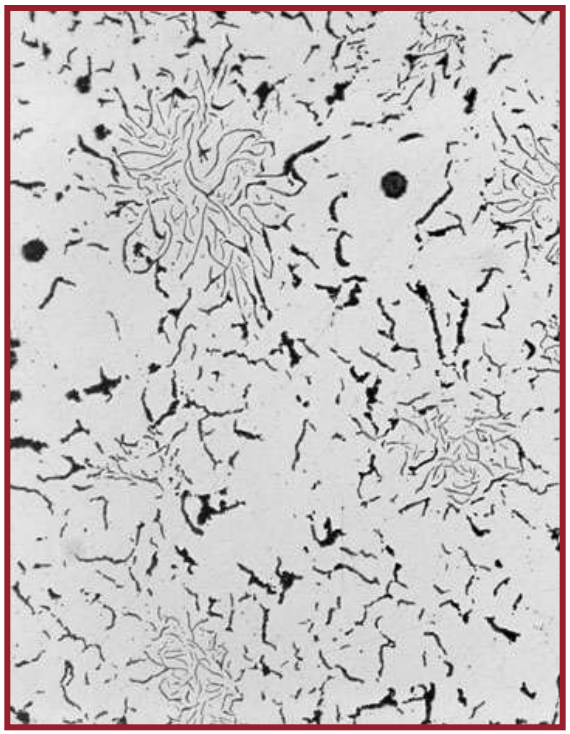
Cooling Rate

Shrinkage



Base Treatment

Plus 0.001% Mg

SinterCast
— Supermetal CGI —

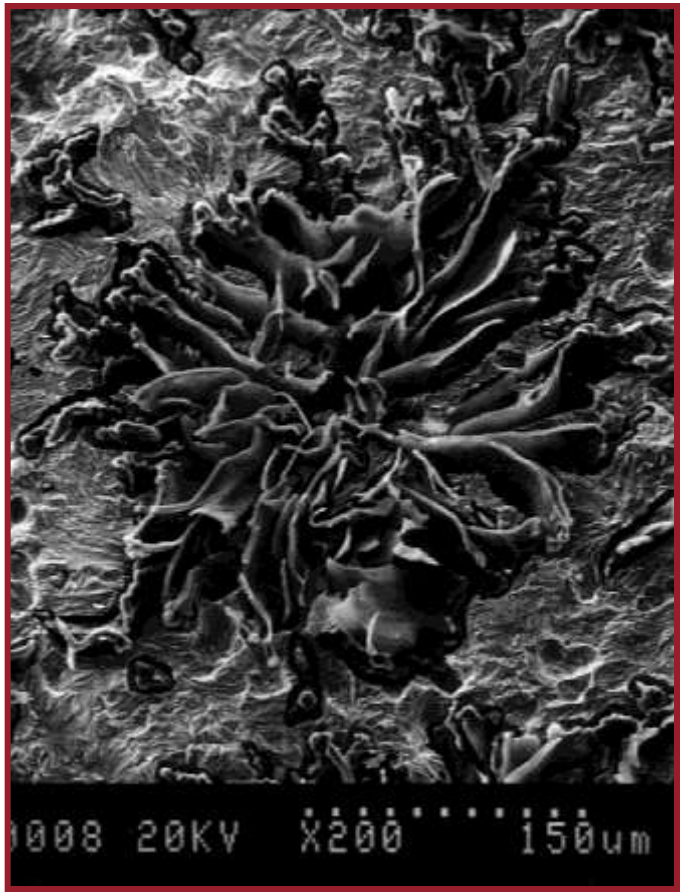
CGI Process Control

Magnesium

Inoculant

Cooling Rate

Shrinkage



SinterCast
— Supermetal CGI —

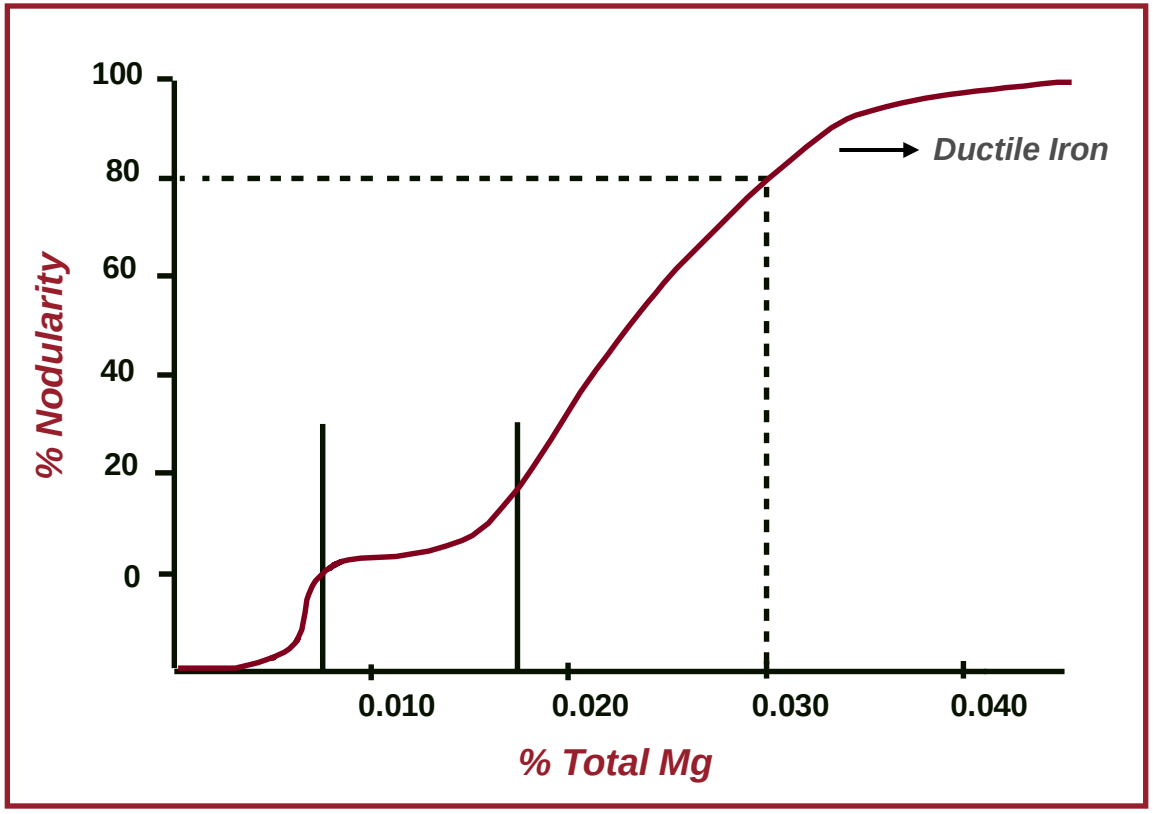
CGI Process Control

Magnesium

Inoculant

Cooling Rate

Shrinkage



SinterCast
— Supermetal CGI —

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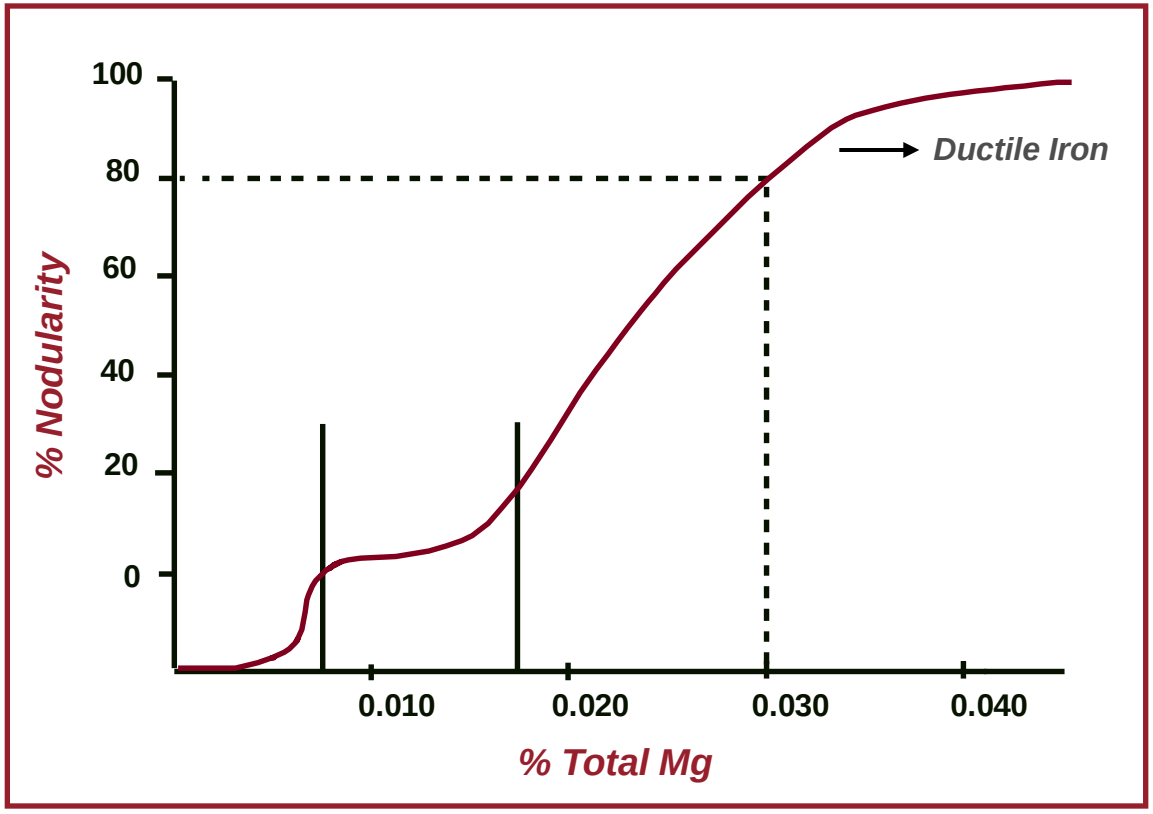

SinterCast
— Supermetal CGI —

CGI Process Control

Magnesium

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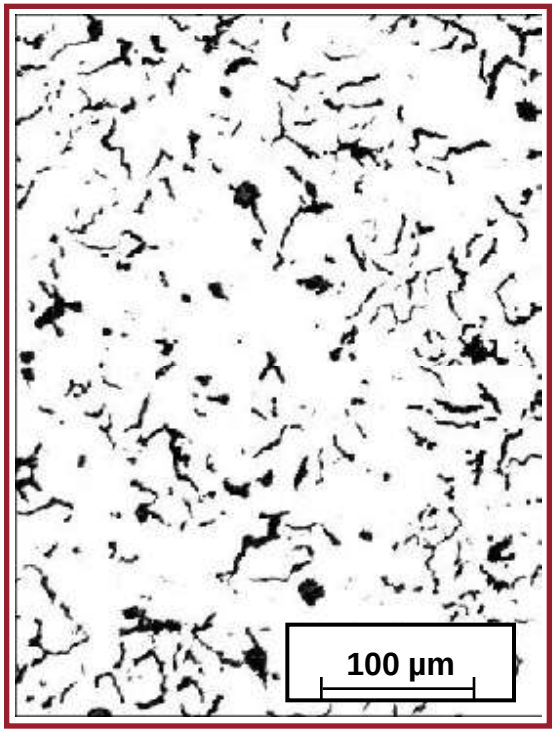
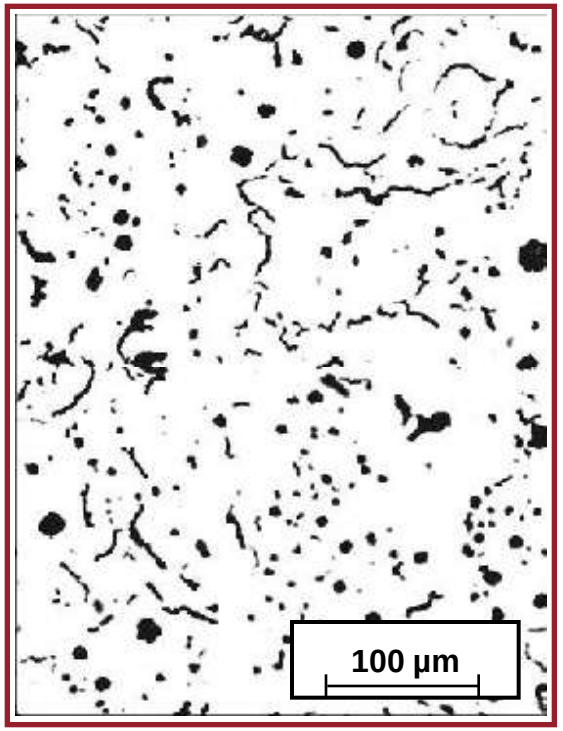


Base Treatment



Plus 0.08% Inoculant

SinterCast
— Supermetal CGI —

CGI Process Control

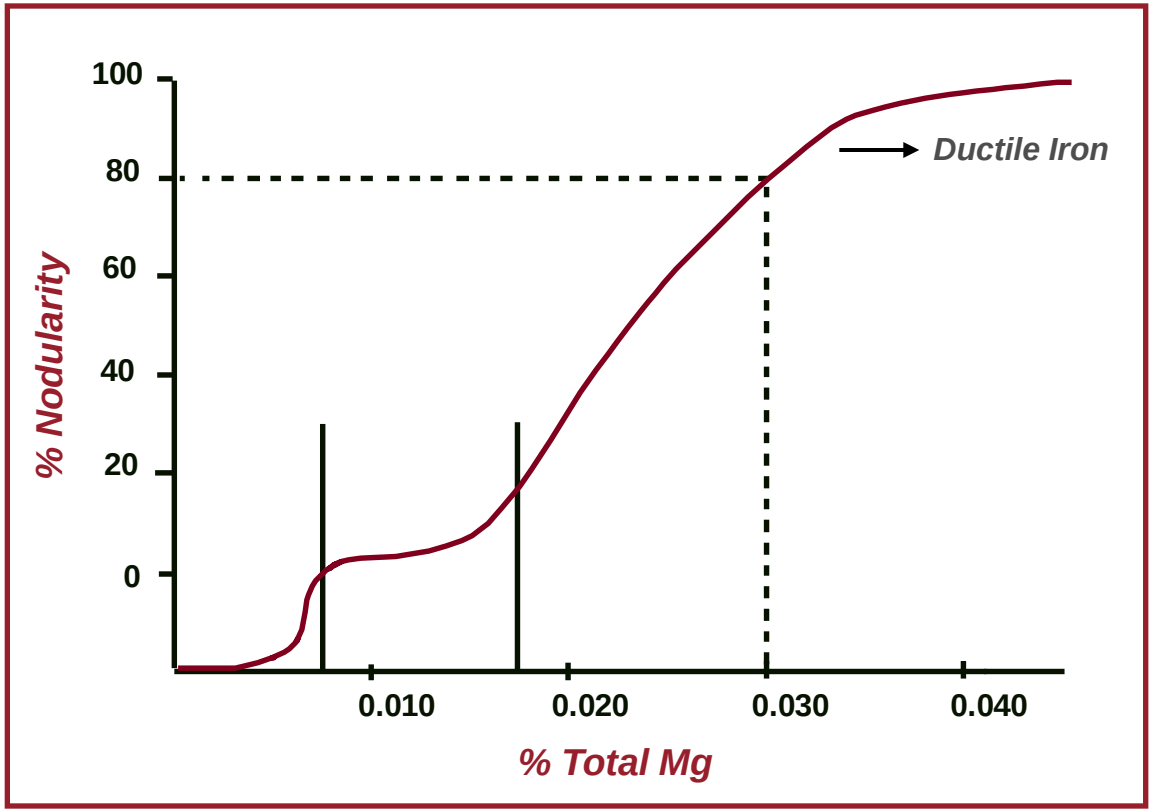
Magnesium

+

Inoculant

Cooling Rate

Shrinkage



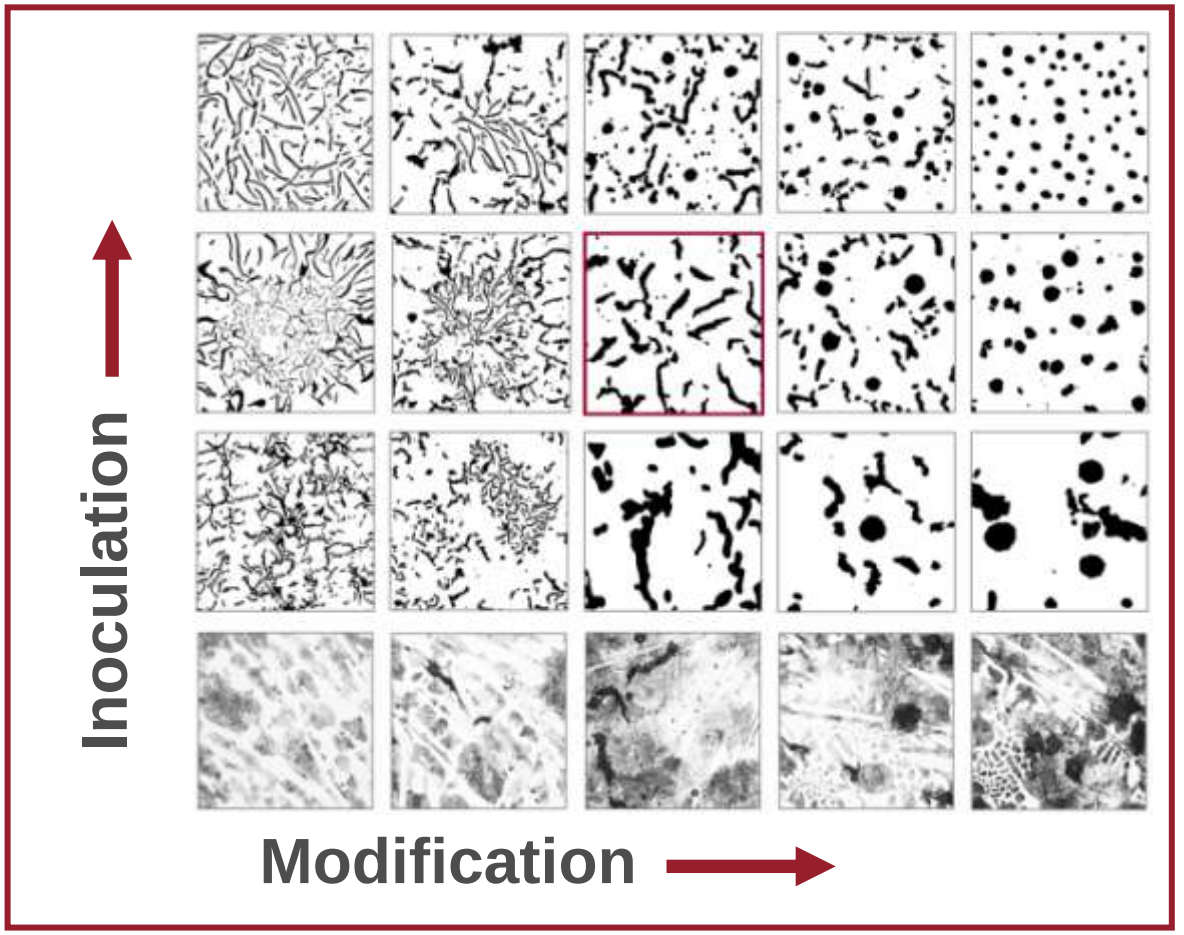
SinterCast
— Supermetal CGI —

CGI Process Control

Magnesium
+
Inoculant

Cooling Rate

Shrinkage



SinterCast
— Supermetal CGI —

CGI Process Control

Magnesium

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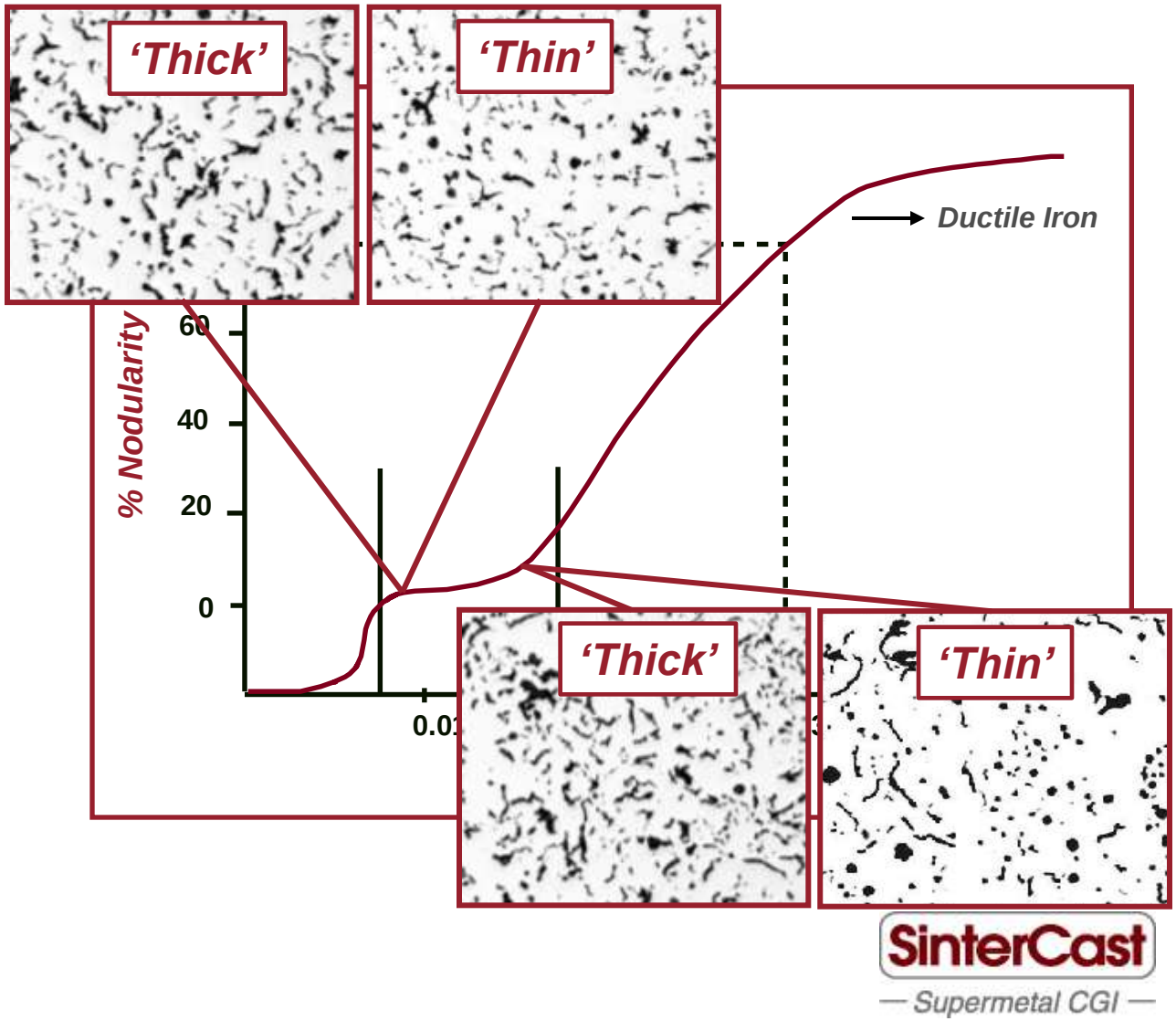
Cooling Rate

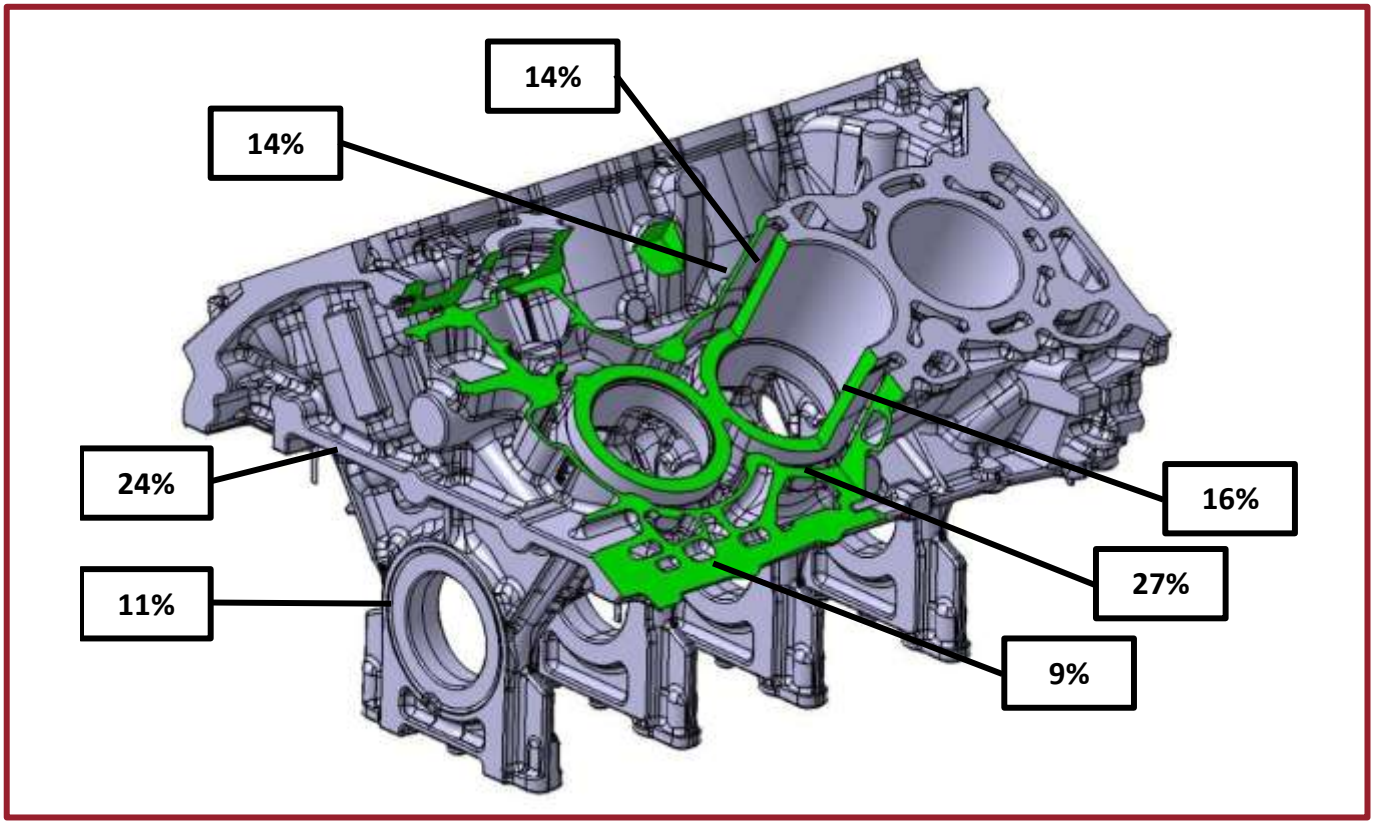
Shrinkage



SinterCast
— Supermetal CGI —

CGI Process Control

Section Sensitivity – Ford 2.7L V6 Petrol

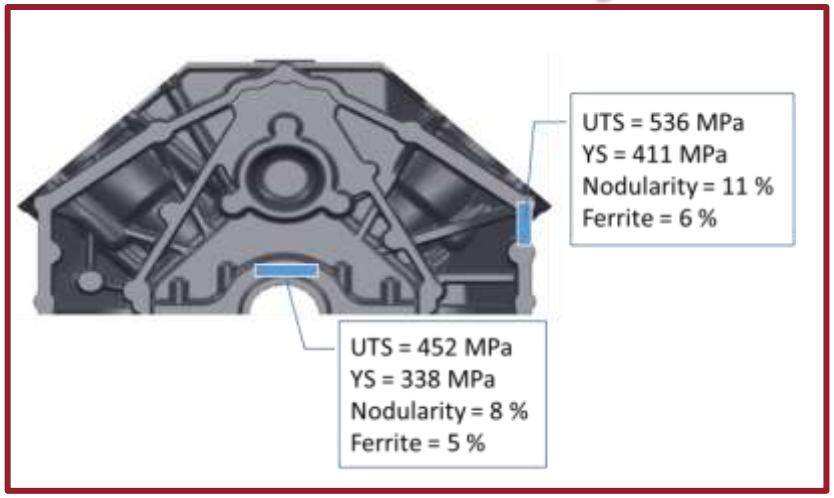


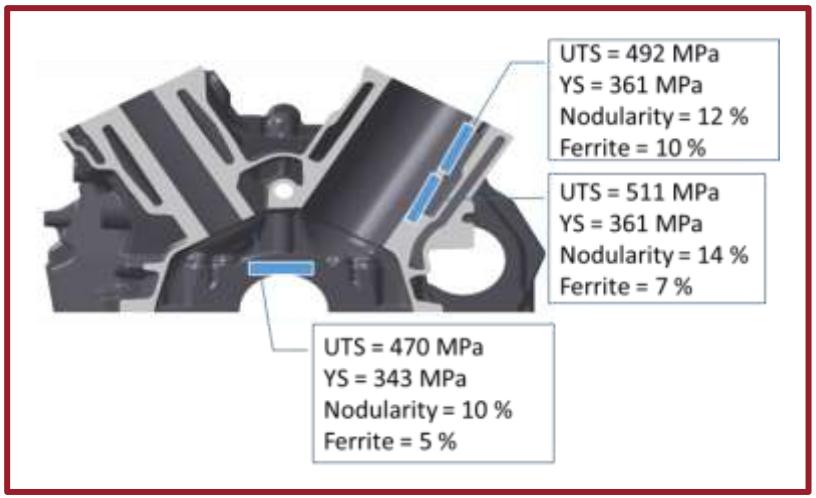
Courtesy Tupy

SinterCast
— Supermetal CGI —

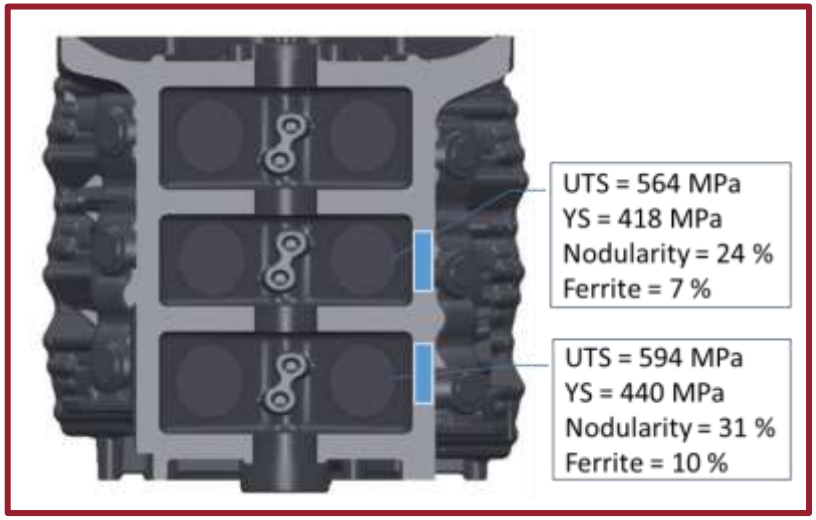
CGI Process Control

Section Sensitivity – Audi 3.0L V6 Diesel





Courtesy Tupy



SinterCast
— Supermetal CGI —

CGI Process Control

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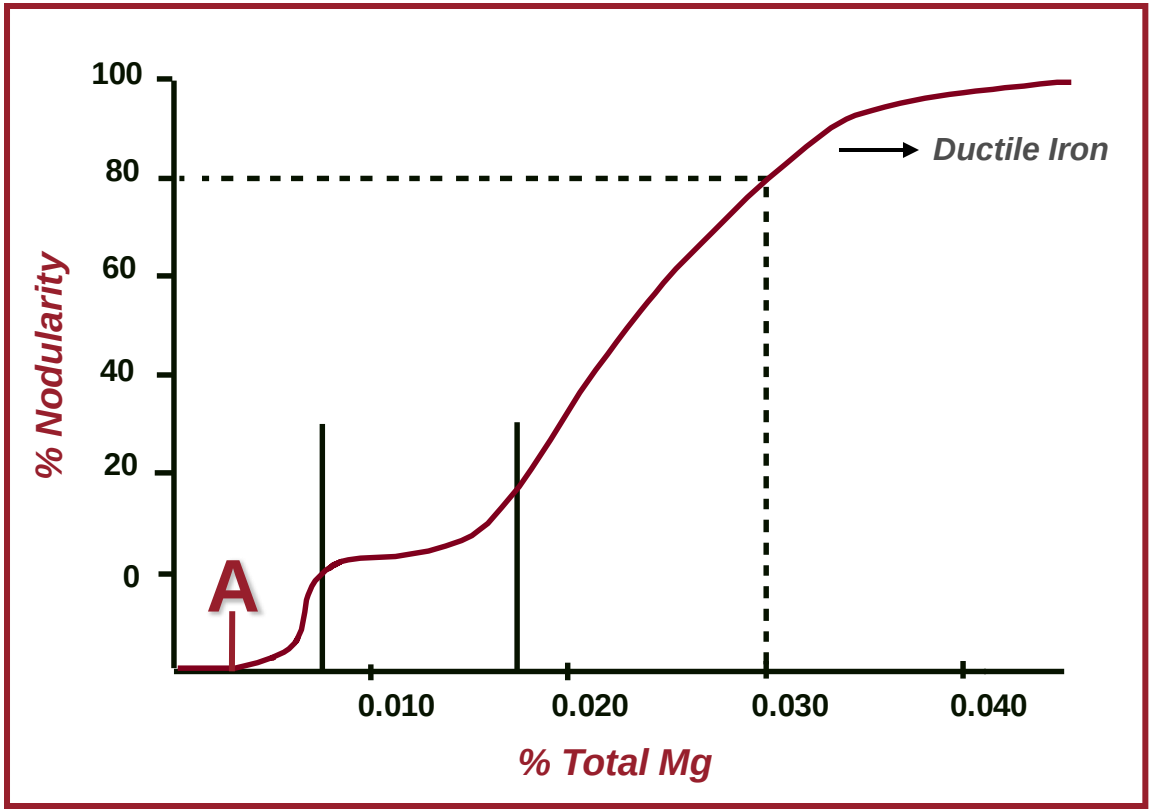
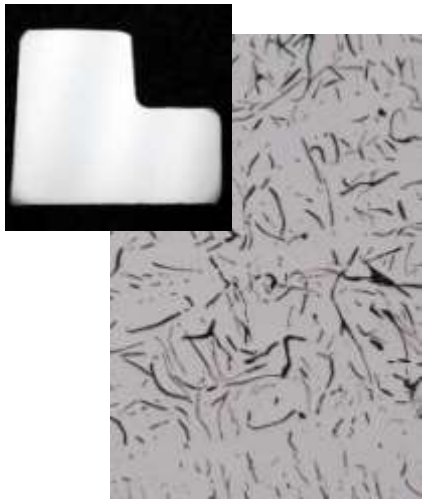


SinterCast
— Supermetal CGI —

CGI Process Control

A **Grey Iron (Reference)**



SinterCast
— Supermetal CGI —

CGI Process Control

Magnesium

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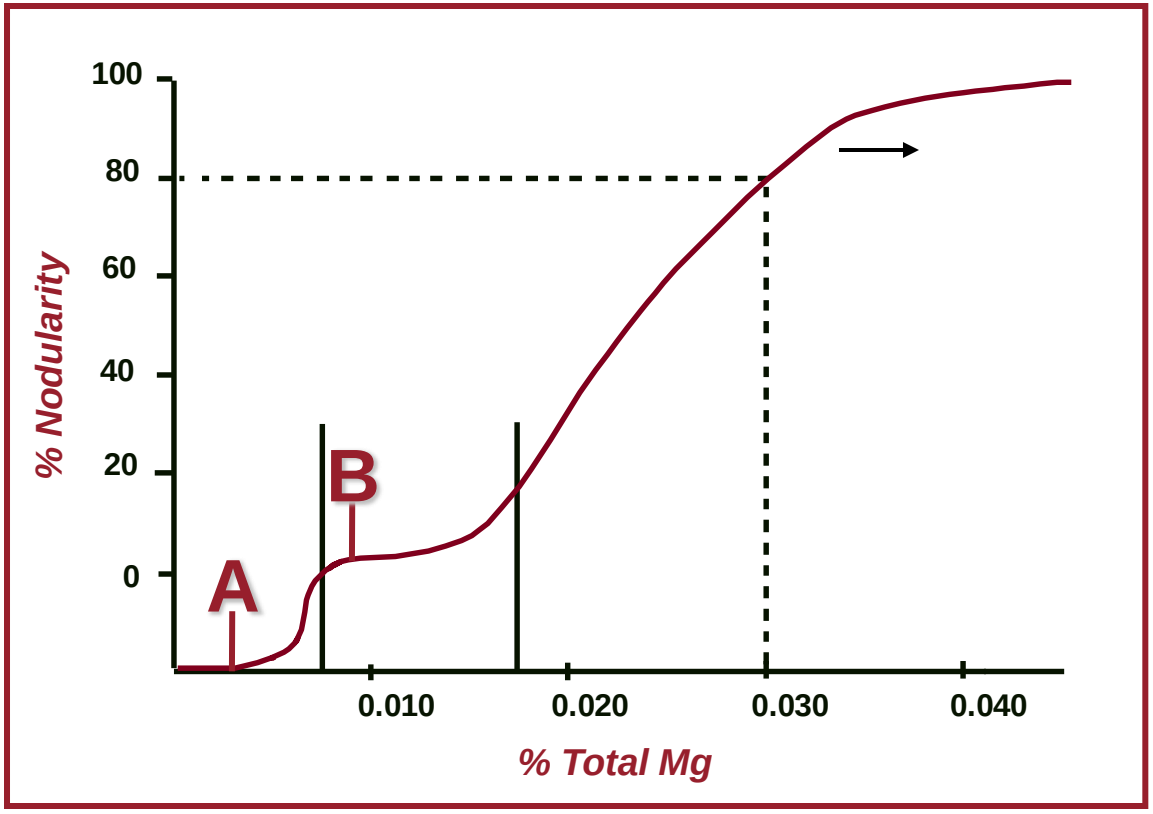
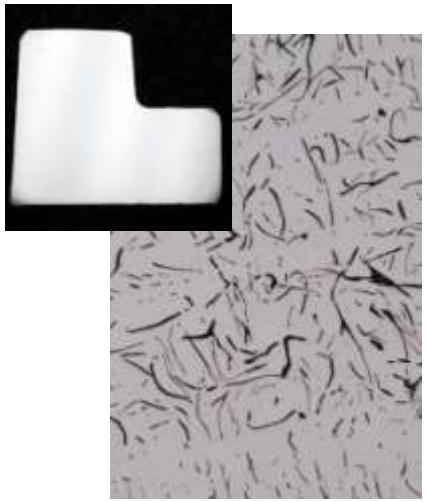


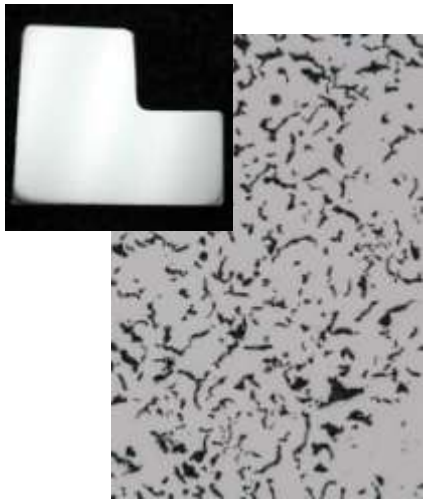
SinterCast
— Supermetal CGI —

CGI Process Control

A Grey Iron (Reference)



B CGI – 7% Nod. (MGM 36)



SinterCast
— Supermetal CGI —

CGI Process Control

Magnesium

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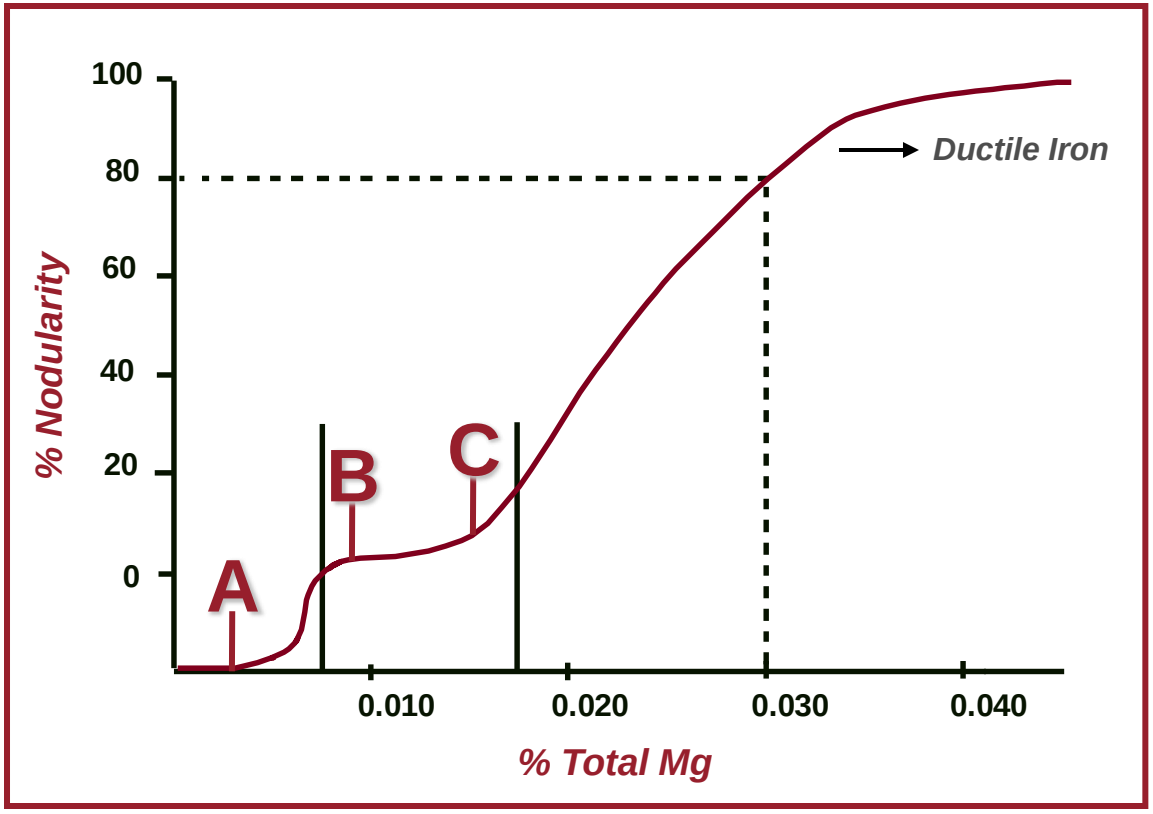
Cooling Rate

Shrinkage



SinterCast
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CGI Process Control

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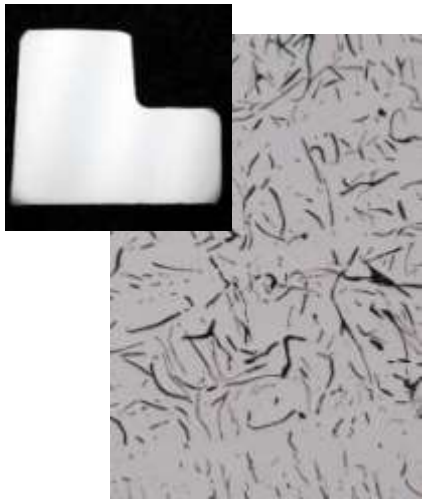

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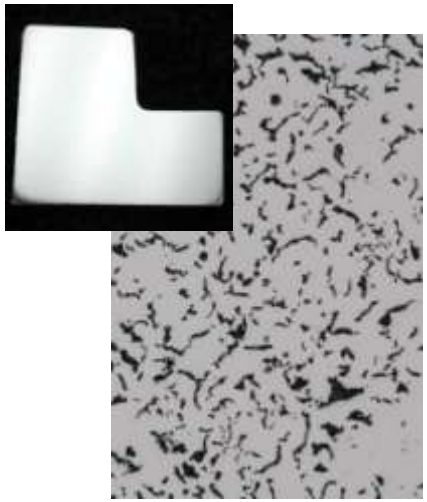
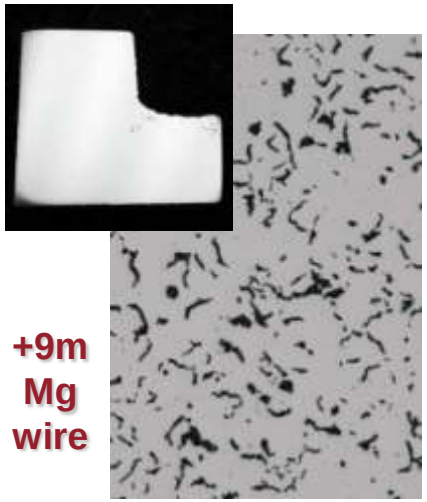


C CGI – 8% Nod. (MGM 44)



+9m Mg wire

SinterCast
— Supermetal CGI —

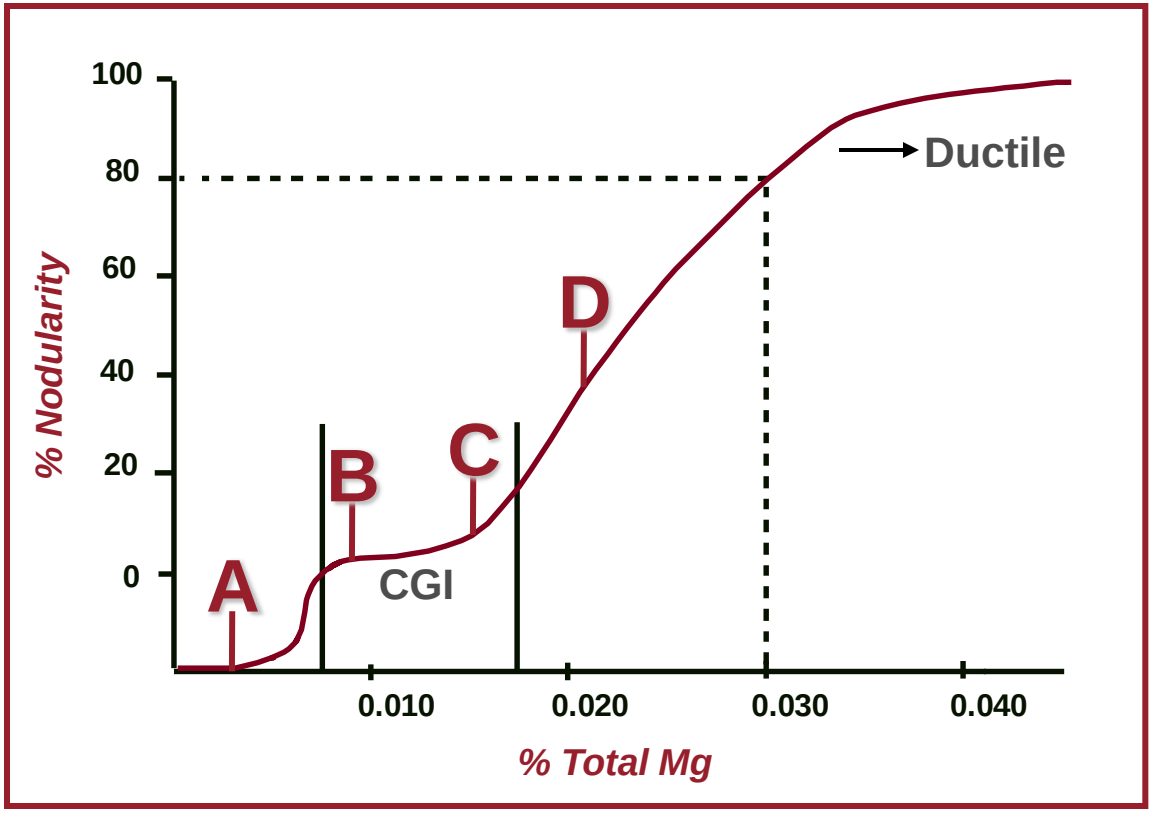
CGI Process Control

Magnesium

Inoculant

Cooling Rate

Shrinkage



SinterCast
— Supermetal CGI —

CGI Process Control

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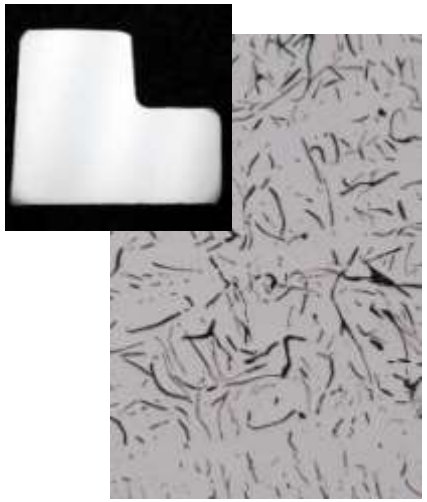

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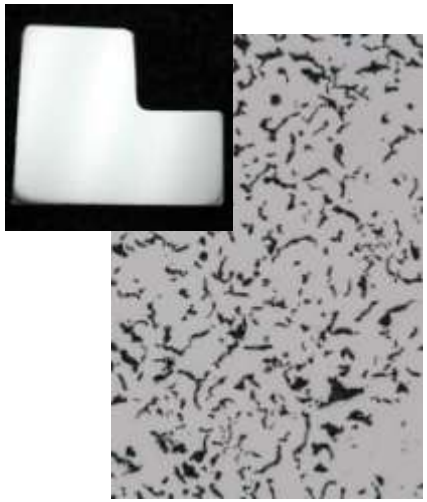

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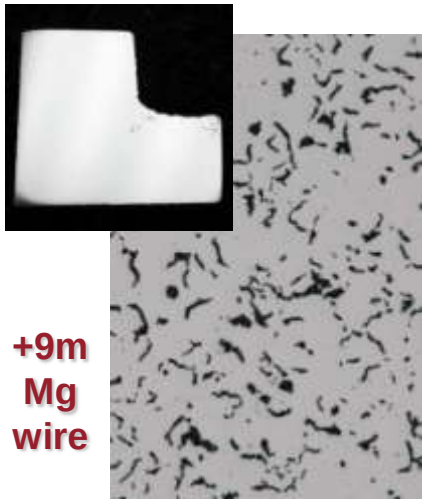
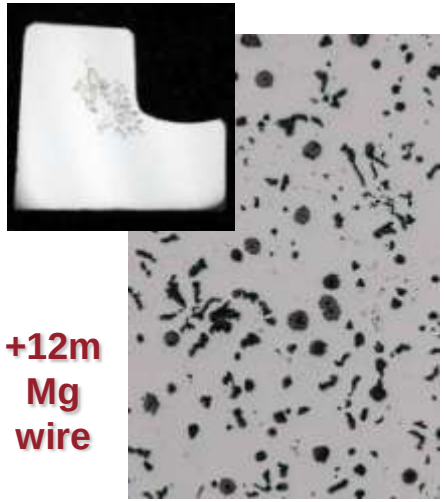


+9m Mg wire

D ~40% Nod. (MGM 58)



+12m Mg wire

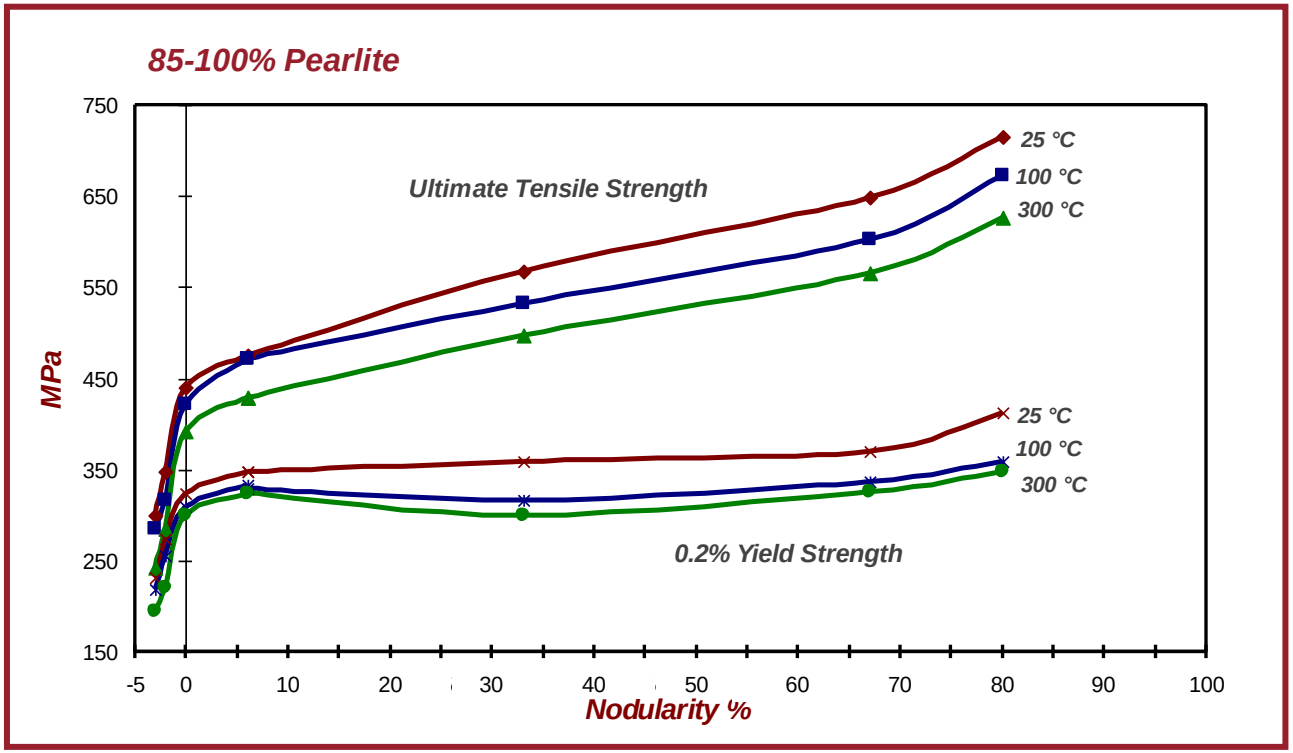
SinterCast
— Supermetal CGI —

What's Important?

SinterCast
— Supermetal CGI —

CGI Process Control – What's Important?

Flake Graphite Control

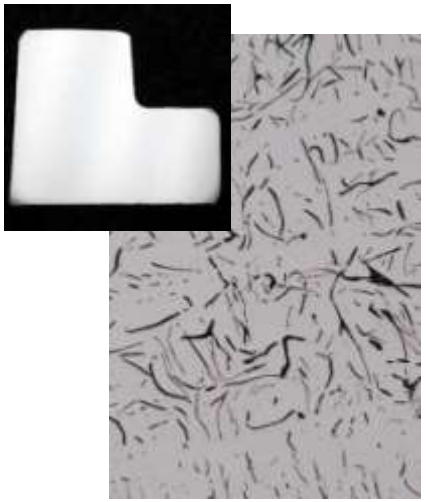


Conclusion: Avoid free flake graphite

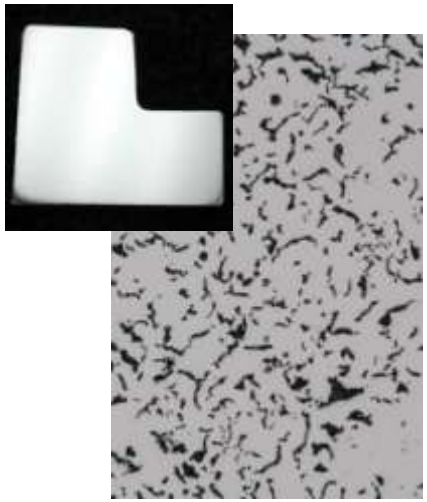
SinterCast
— Supermetal CGI —

CGI Process Control – What's Important?

A Grey Iron (Reference)



B CGI – 7% Nod. (MGM 36)



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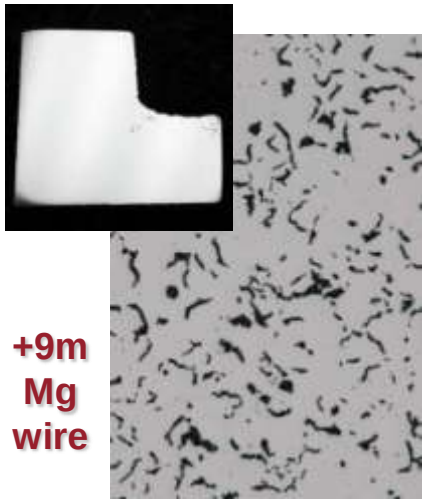

+9m Mg wire

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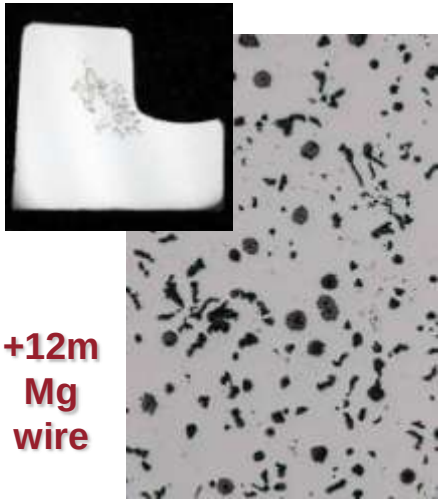


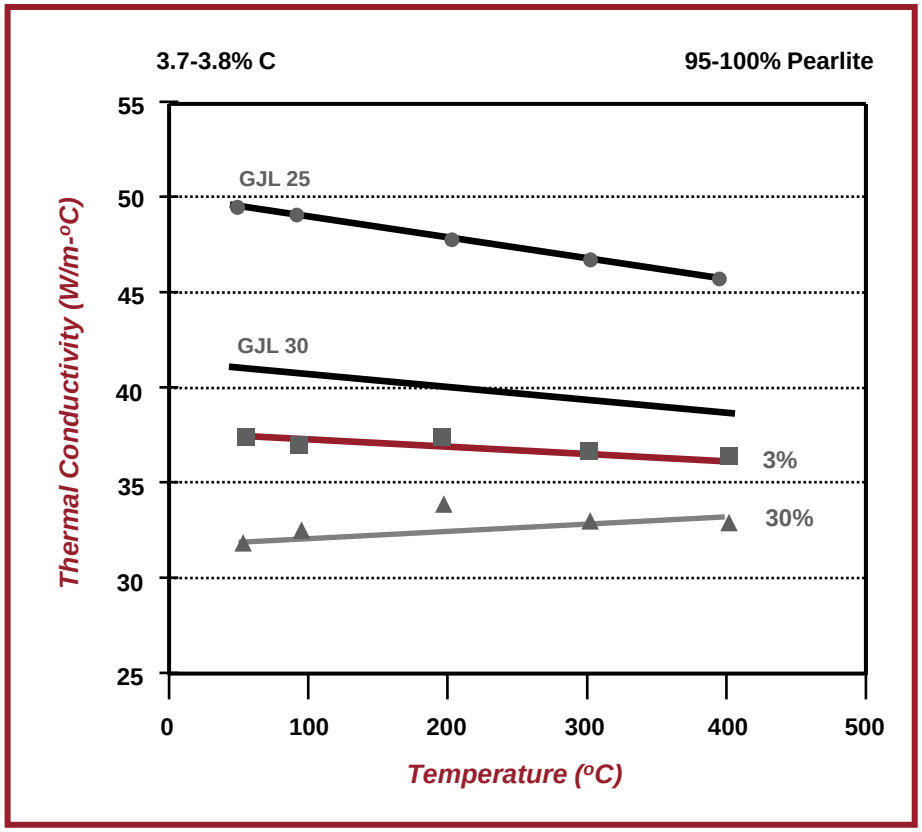
+12m Mg wire

Conclusion: keep the nodularity low

SinterCast — Supermetal CGI —

CGI Process Control – What's Important?

Thermal Conductivity

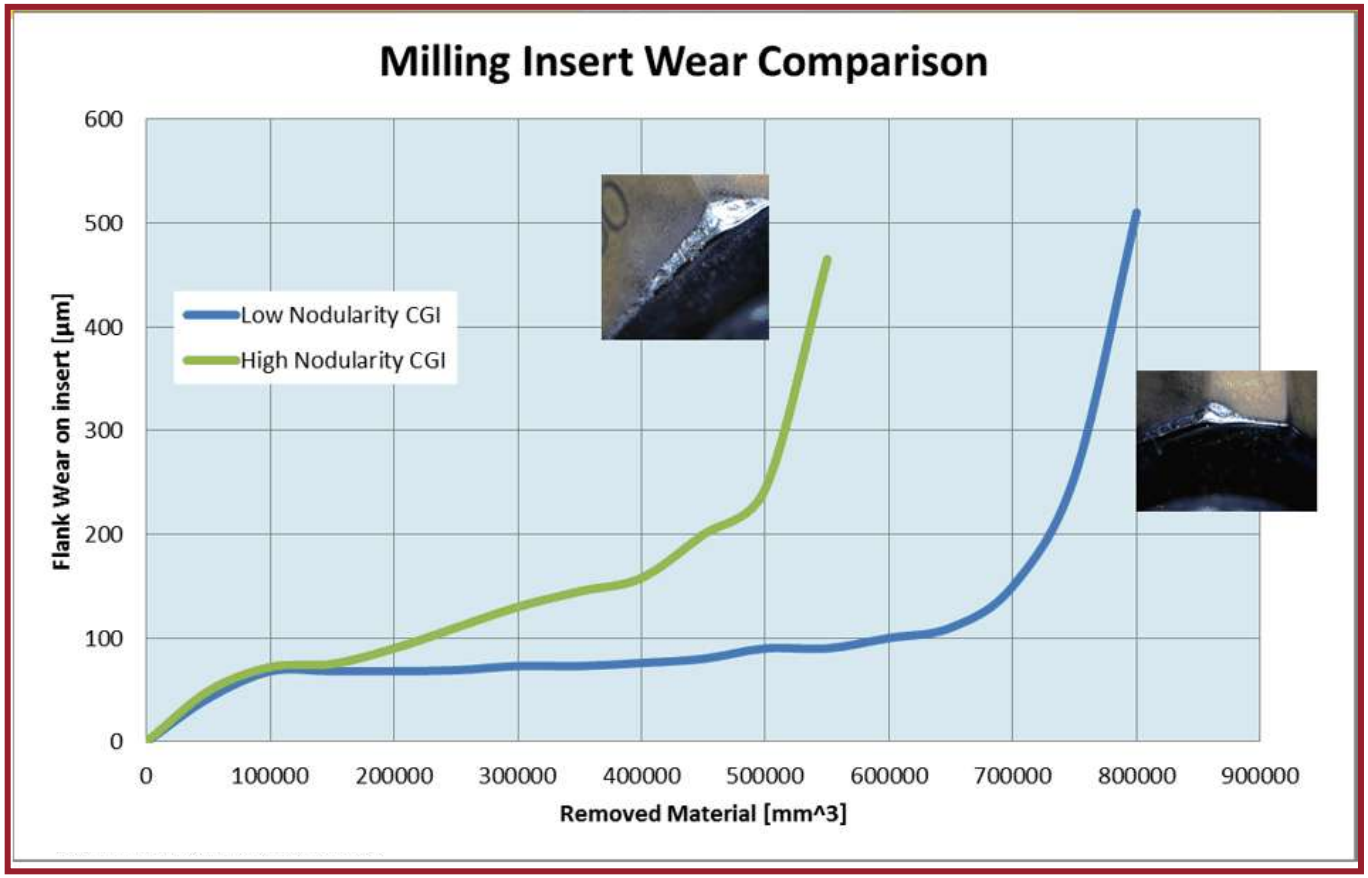


Conclusion: keep the nodularity low

SinterCast
— Supermetal CGI —

CGI Process Control – What's Important?

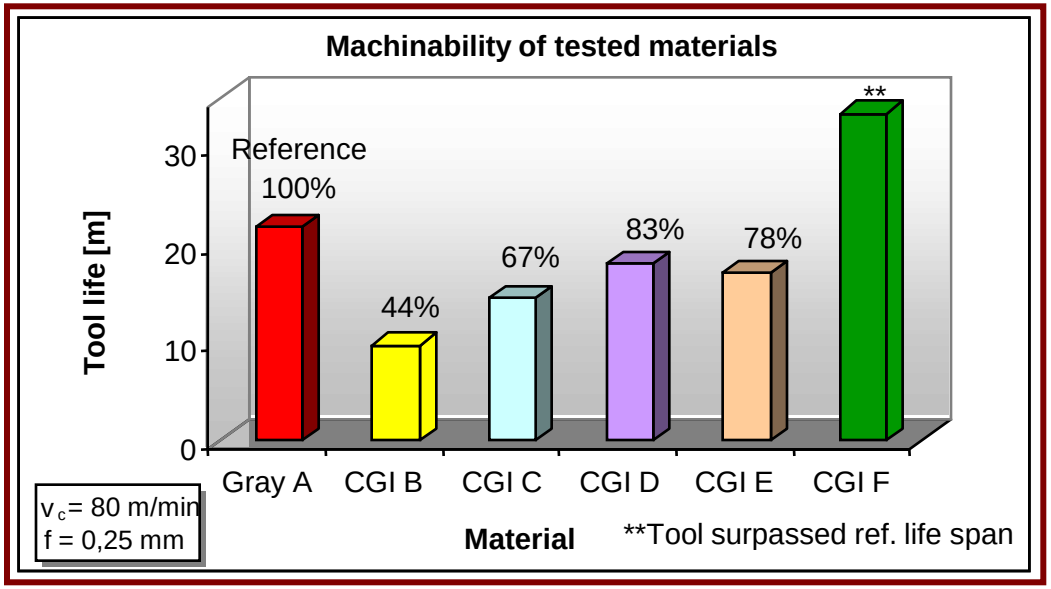
Machinability – Nodularity Control



Conclusion: keep the nodularity low

SinterCast
— Supermetal CGI —

CGI Process Control – What's Important?



(Courtesy Tupy)

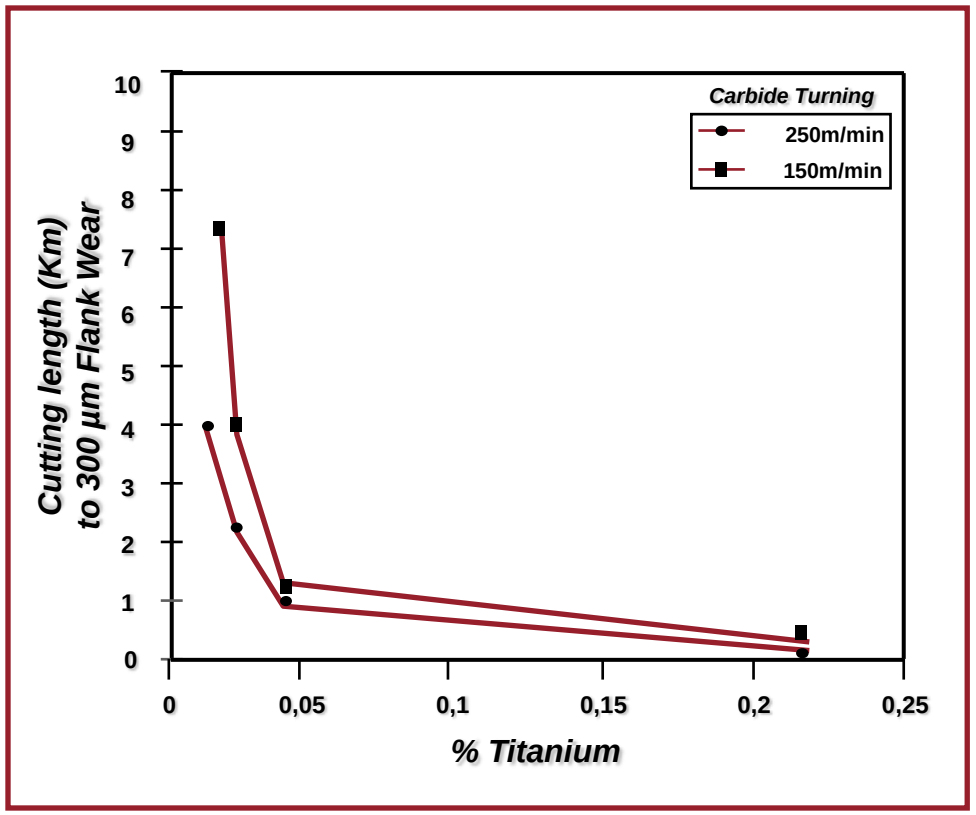
Properties	Grey Iron	CGI - B	CGI - C	CGI - D	CGI - E	CGI - F
Nodularity (%)	Flake	36	8	9	14	11
Pearlite (%)	> 97	99	84	89	90	39
Hardness (BHN)	220	229	237	229	229	173
Tensile (MPa)	250	550	450	450	450	350

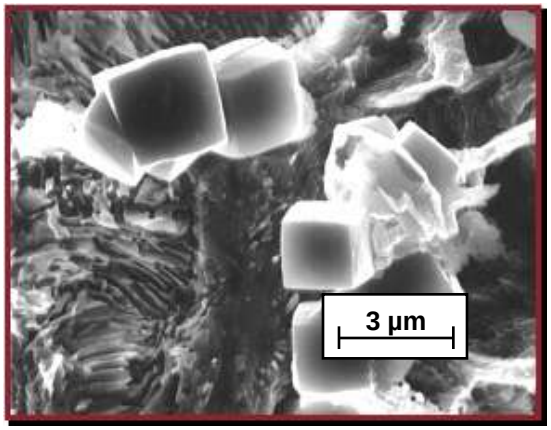
Conclusion: keep the nodularity low

SinterCast
— Supermetal CGI —

CGI Process Control – What's Important?

Machinability – Titanium Content





Inclusion Engineering?

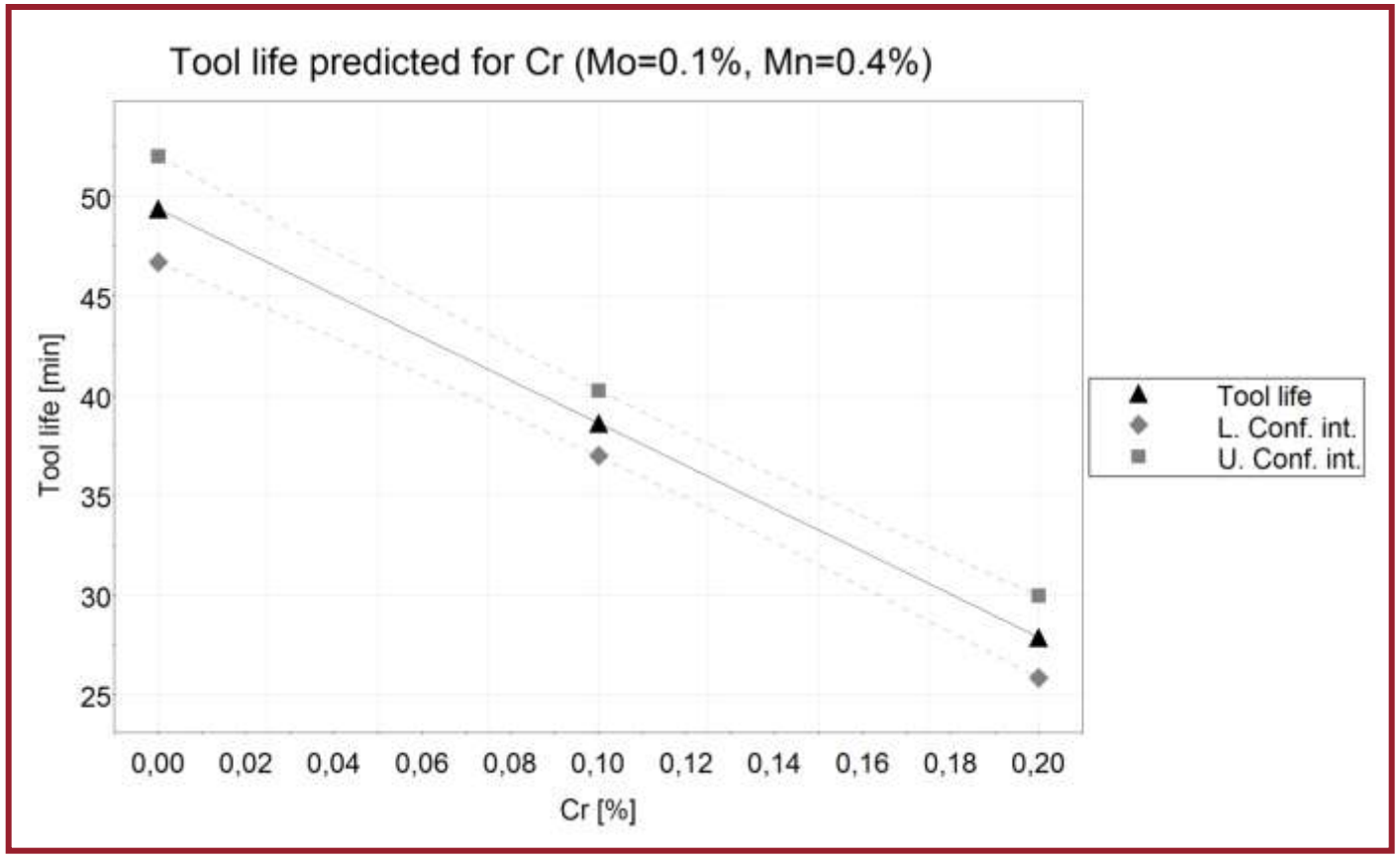
%Ti	TiC/mm^2
0.01	<100
0.02	100–300
0.13	1000
0.22	> 2000

Conclusion: keep the titanium low

SinterCast
— Supermetal CGI —

CGI Process Control – What's Important?

Machinability Chromium Control



Conclusion: keep the chromium low

SinterCast
— Supermetal CGI —