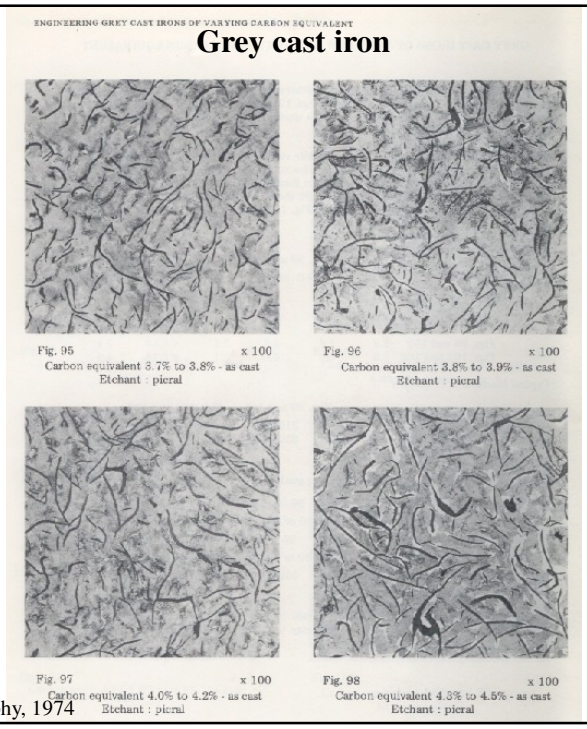
Microstructures of

different types of cast irons

BN, Dept. Mat. Eng., IUT, IRAN

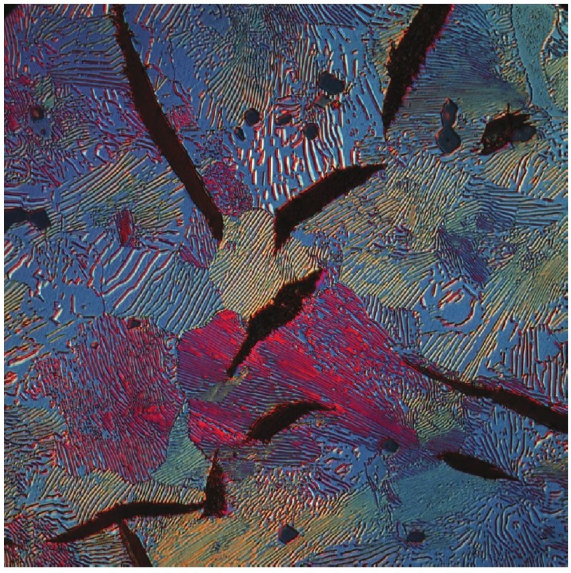
Grey cast iron



Foundry Metallography, 1974

2

Grey cast iron

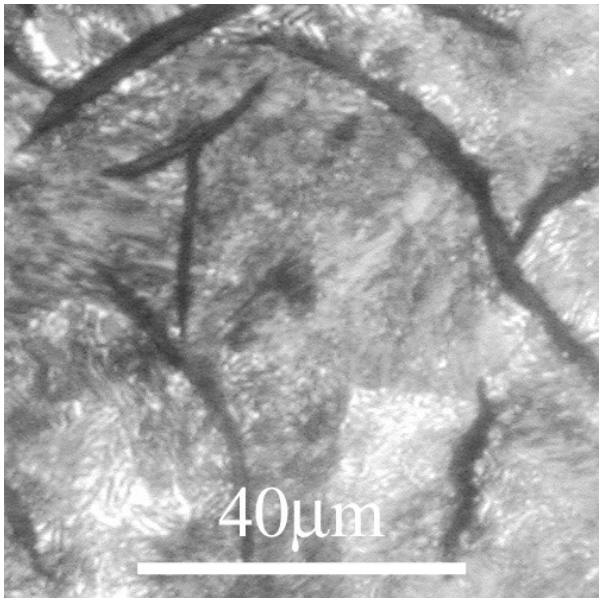


Doug Culley, research technologist in the department of materials science and engineering at McMaster Univ., Hamilton, Ontario, Canada, used a sample of gray cast iron, taken using differential interference contrast at 1,000 times magnification, to teach his students to identify the pearlite structure orientation and different grains in the metal. He was struck by the unique colors and contrasts produced using various microscopy techniques and submitted it to the 2009 Nikon Small World Photomicrography competition. The photo won image of distinction honors. METAL

3

Modern Casting, 2012

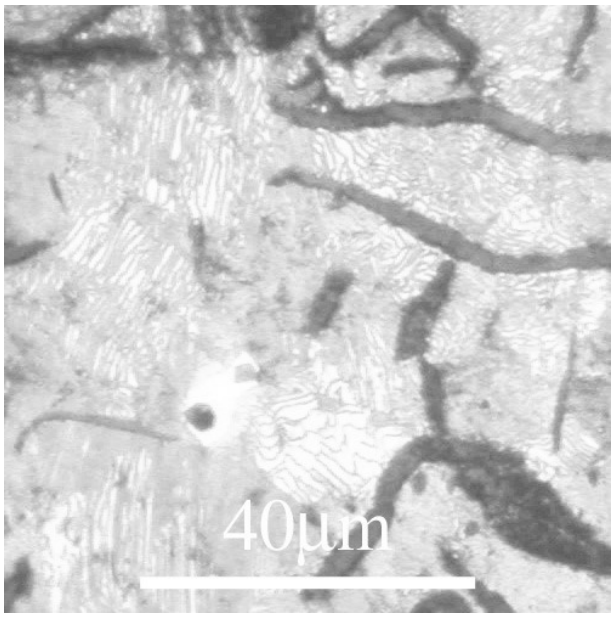
Grey cast iron



4

http://www.doitpoms.ac.uk/miclib/index.php

Grey cast iron



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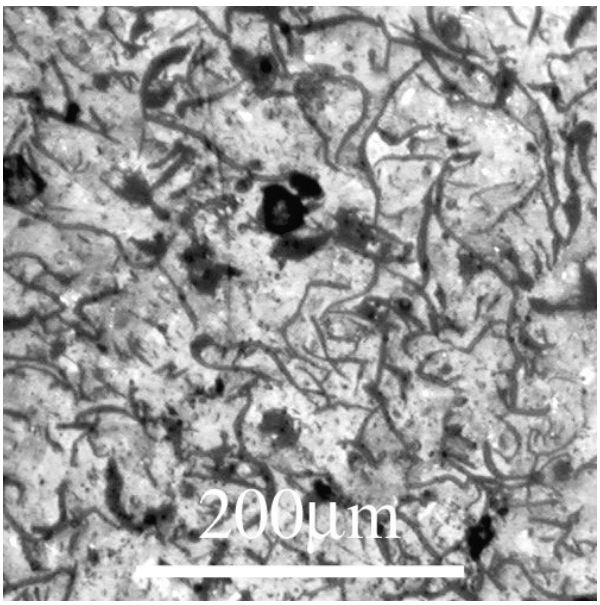
http://www.doitpoms.ac.uk/miclib/index.php

Grey cast iron



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http://www.doitpoms.ac.uk/miclib/index.php

Grey cast iron

http://www.doitpoms.ac.uk/miclib/index.php

7

Grey cast iron

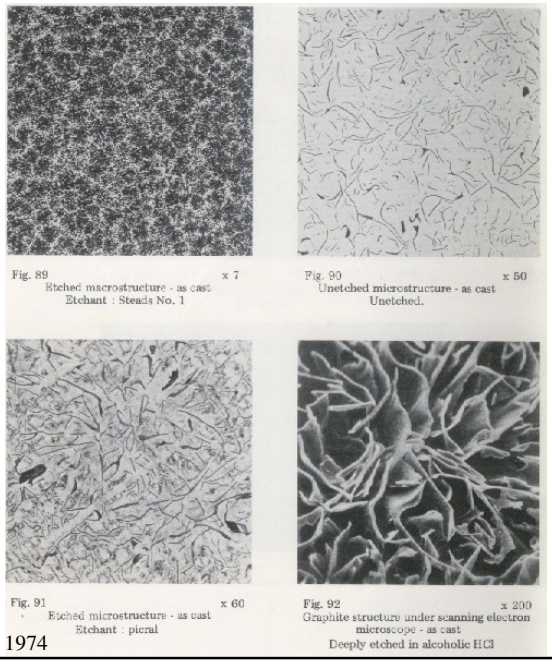


Fig. 89 x 7
Etched macrostructure - as cast
Etchant : Steads No. 1

Fig. 90 x 50
Unetched microstructure - as cast
Unetched.

Fig. 91 x 60
Etched microstructure - as cast
Etchant : picral

Fig. 92 x 200
Graphite structure under scanning electron microscope - as cast
Deeply etched in alcoholic HCl

Foundry Metallography, 1974

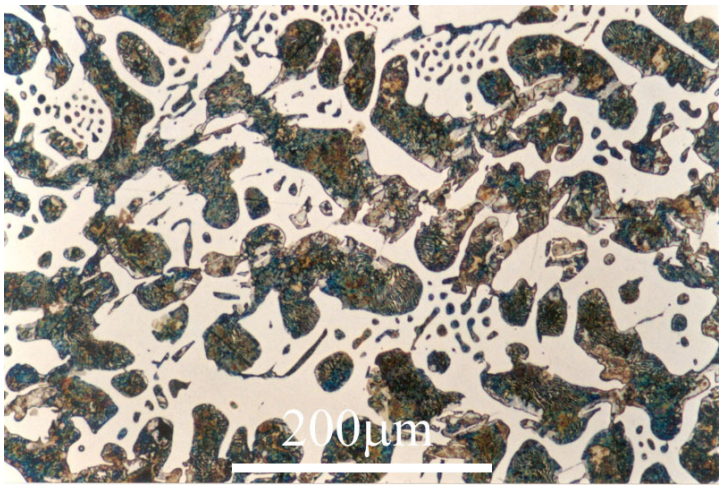
8

Hyper eutectic cast Iron

9

http://www.doitpoms.ac.uk/miclib/index.php

White iron



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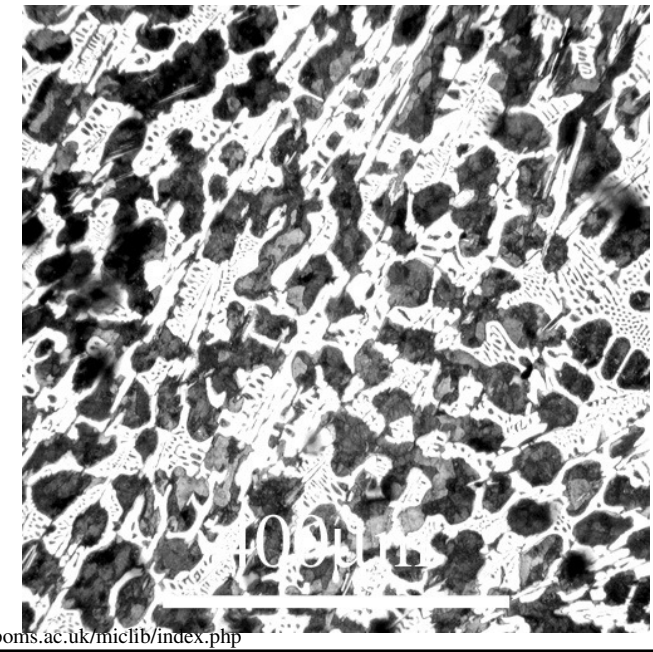
http://www.doitpoms.ac.uk/miclib/index.php

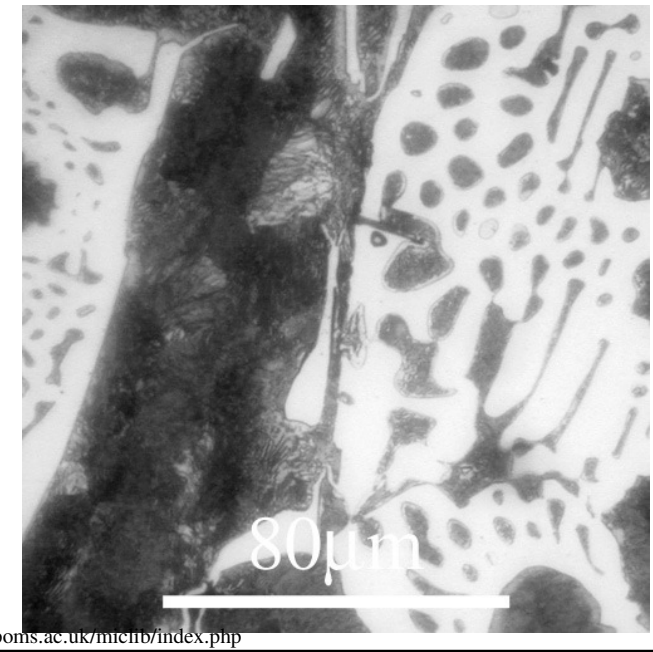
White iron



http://www.doitpoms.ac.uk/miclib/index.php

11

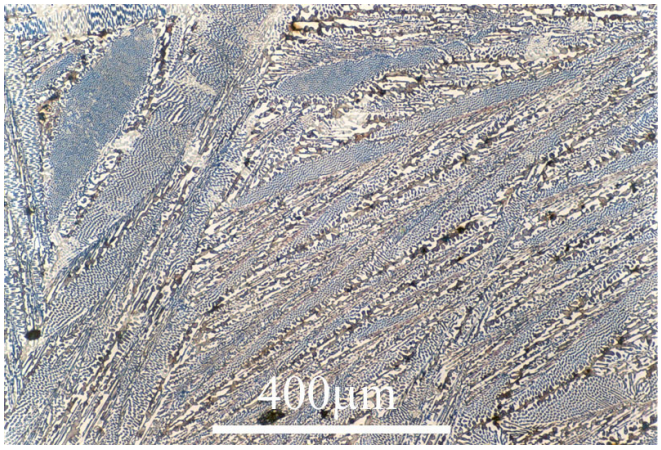
White iron



http://www.doitpoms.ac.uk/miclib/index.php

12

White iron



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http://www.doitpoms.ac.uk/miclib/index.php

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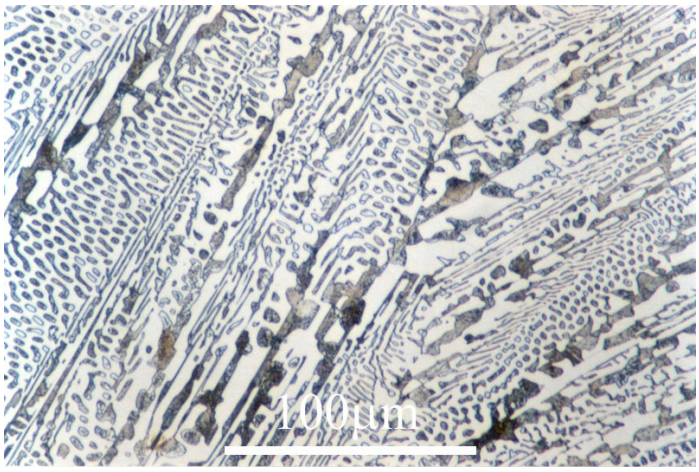

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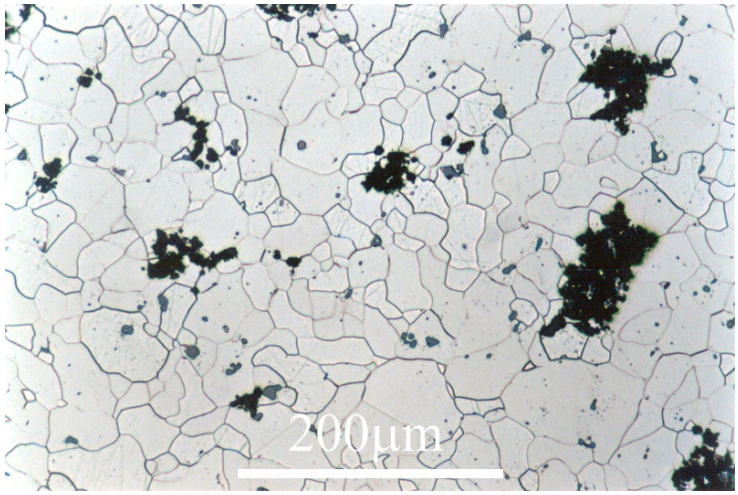
http://www.doitpoms.ac.uk/miclib/index.php

Malleable cast Iron



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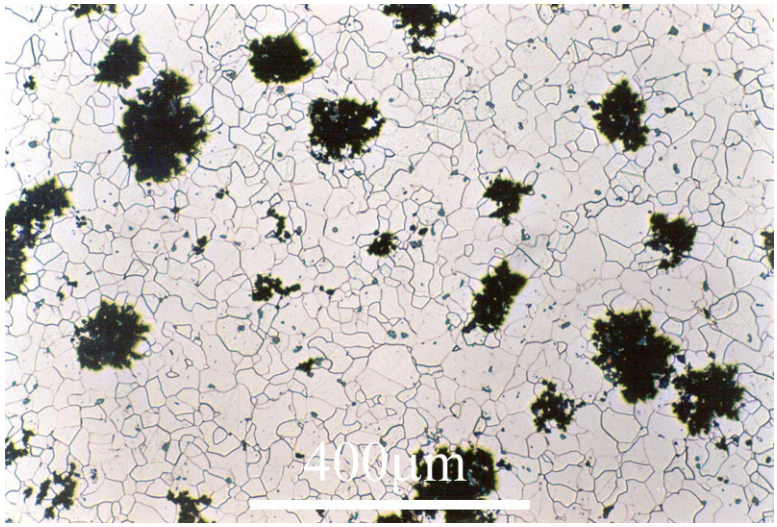
Malleable cast Iron



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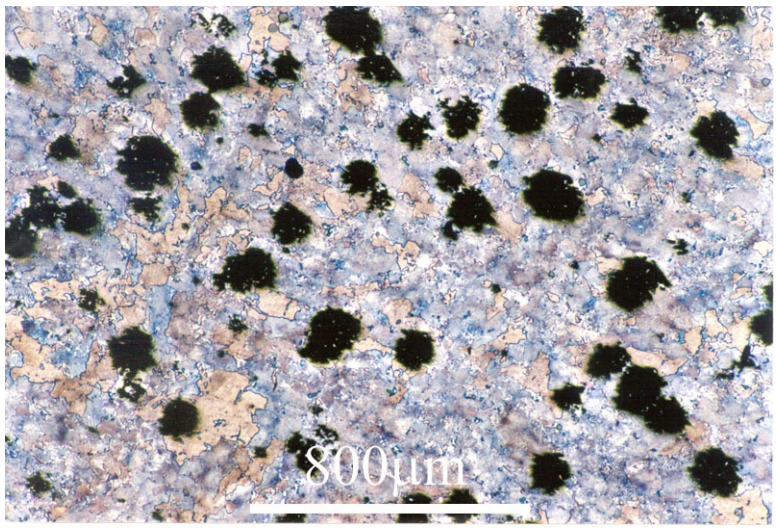

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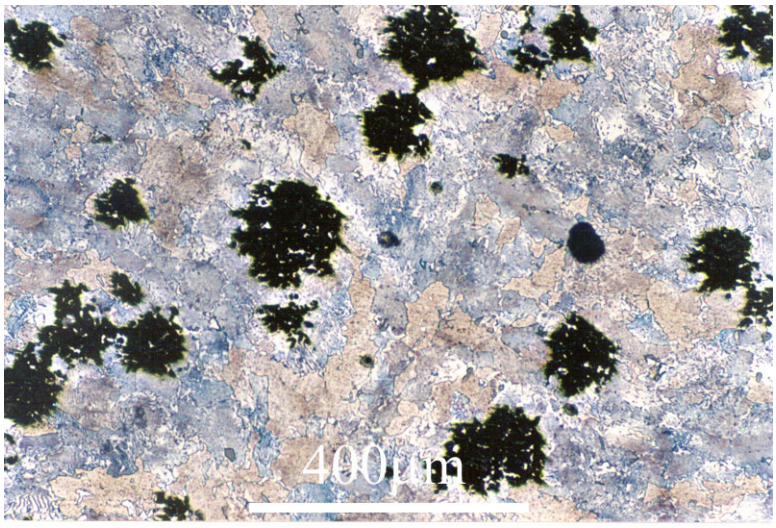

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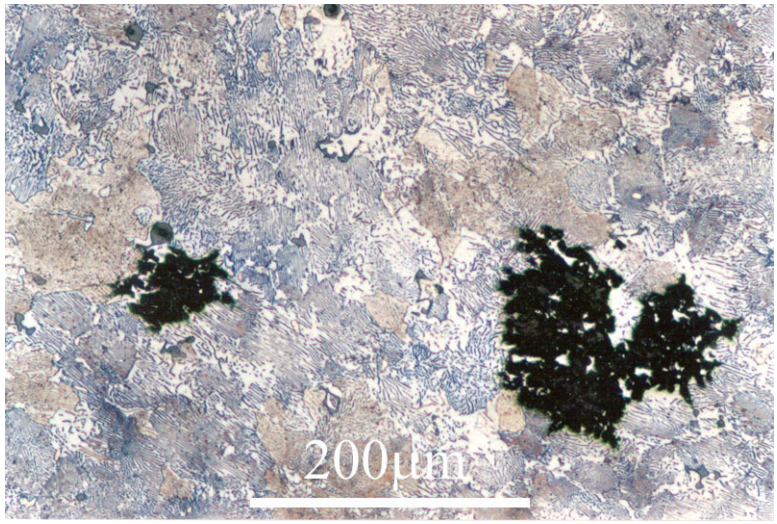
Malleable cast Iron



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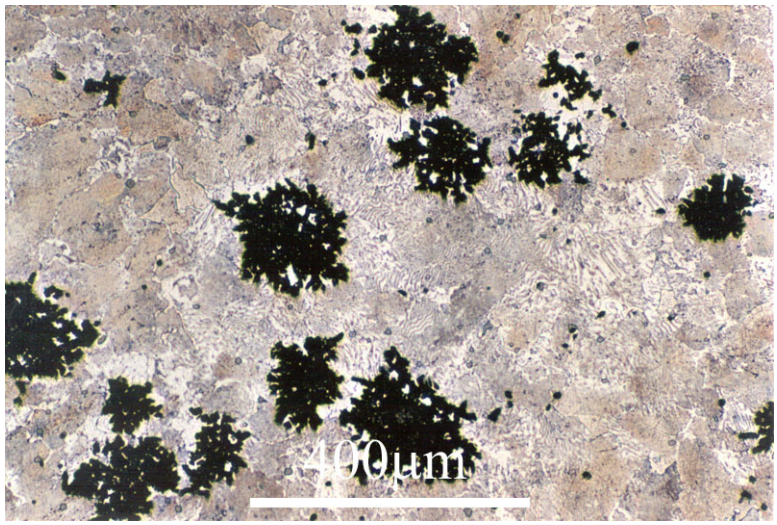
Malleable cast Iron



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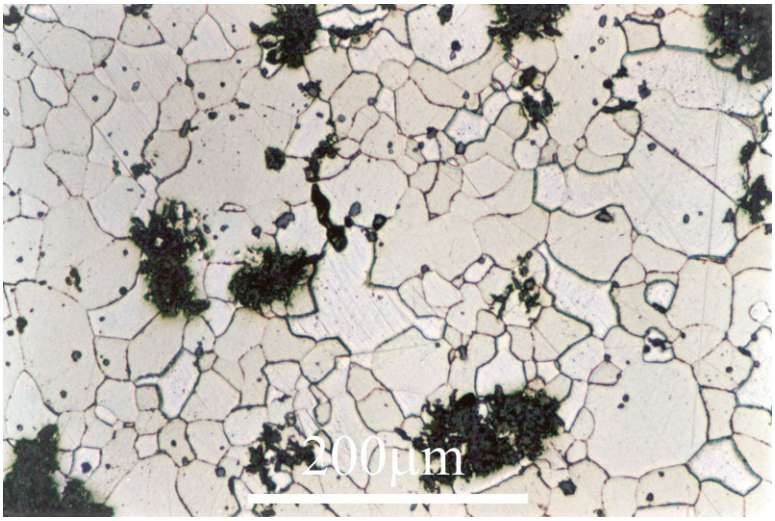
Malleable cast Iron



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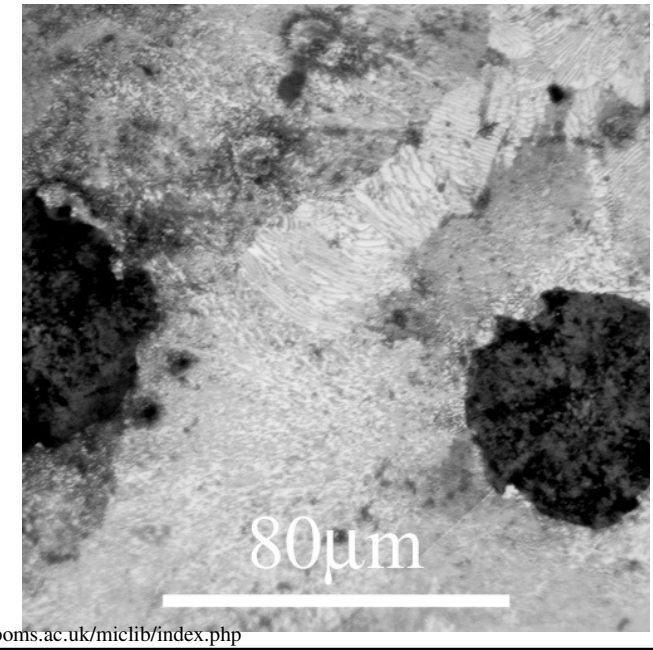
http://www.doitpoms.ac.uk/miclib/index.php

Ductile cast Iron



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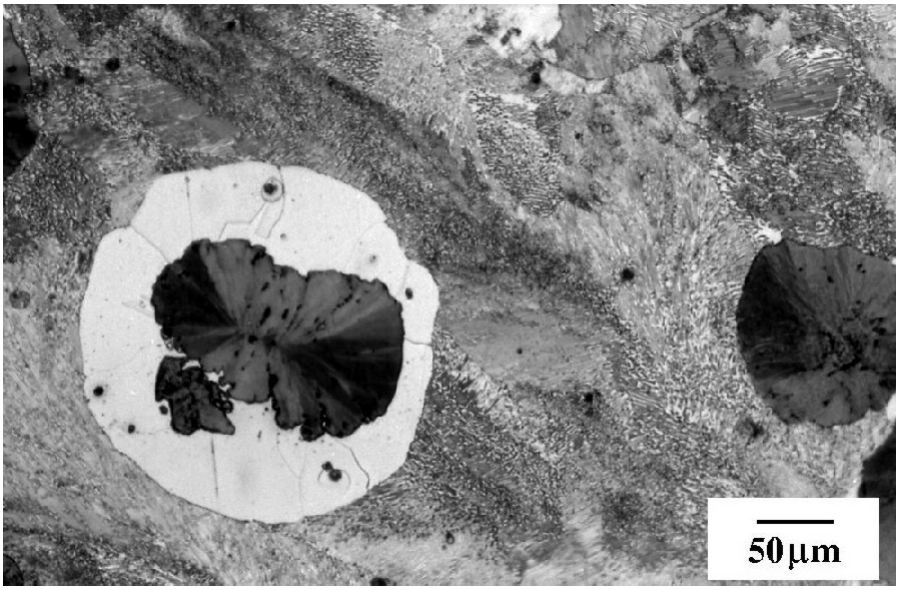
Ductile cast Iron



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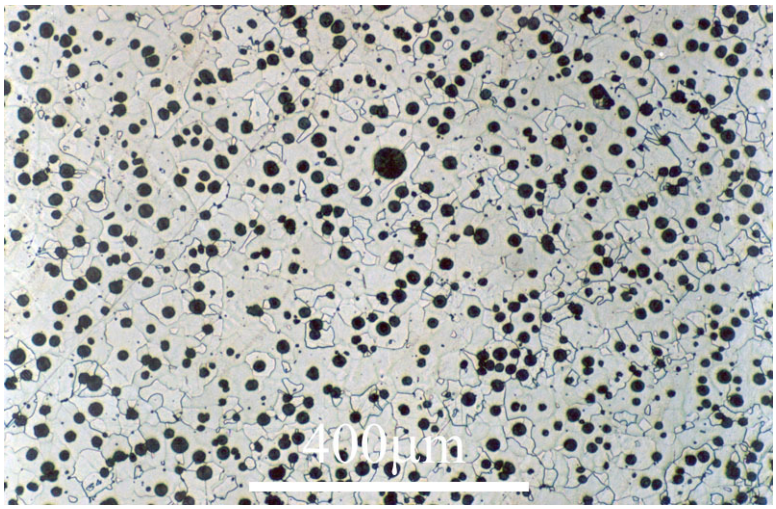
Ductile cast Iron



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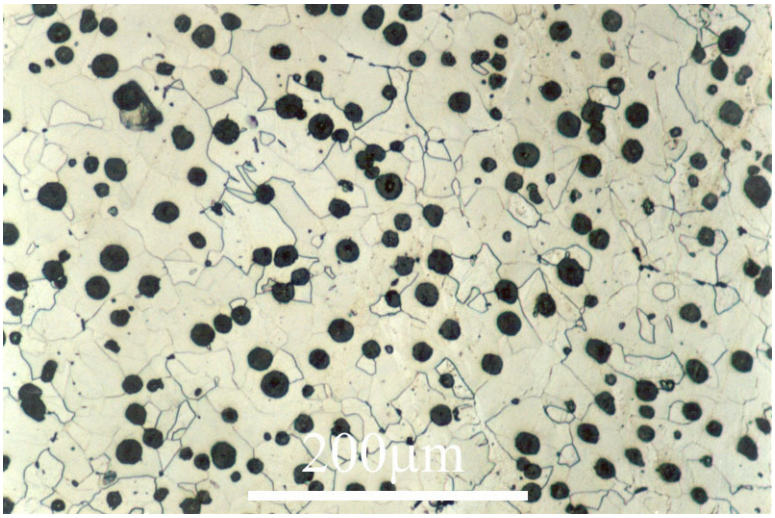
Ductile cast Iron



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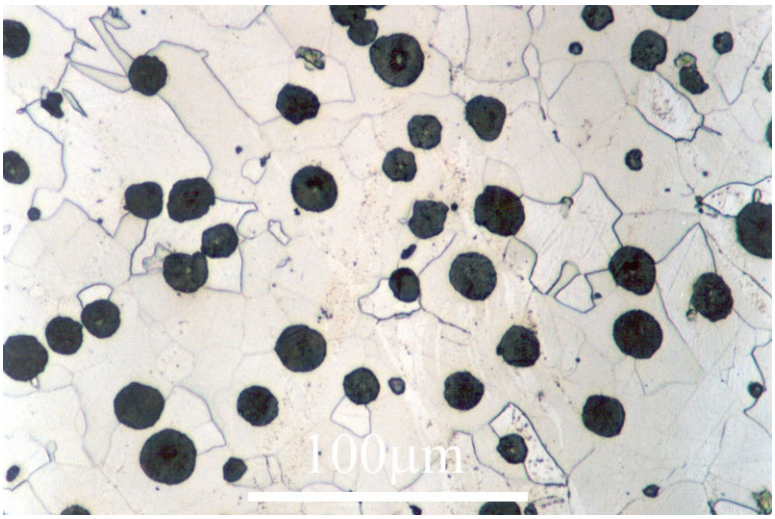
Ductile cast Iron



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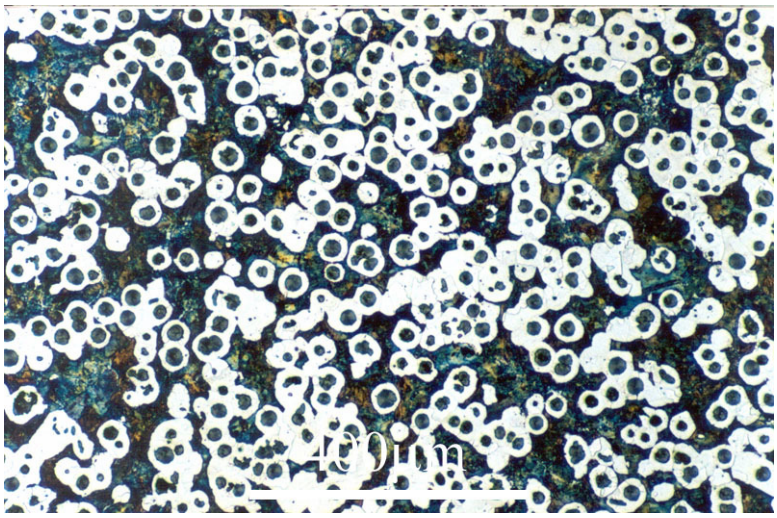

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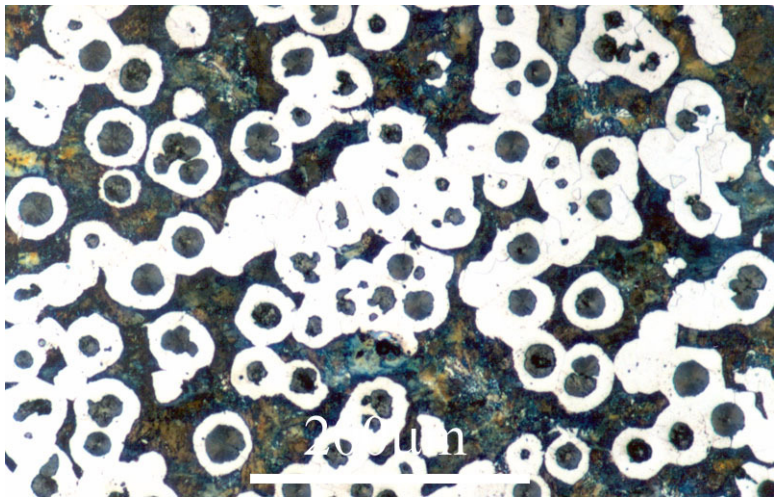

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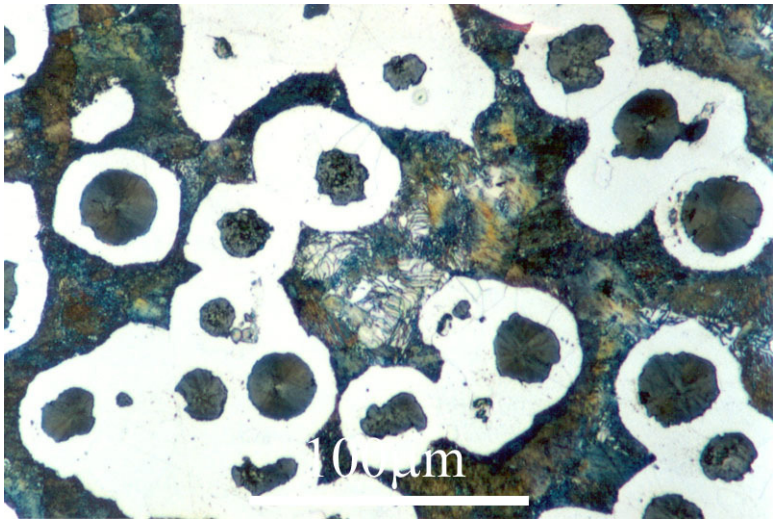
Ductile cast Iron



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Ductile cast Iron

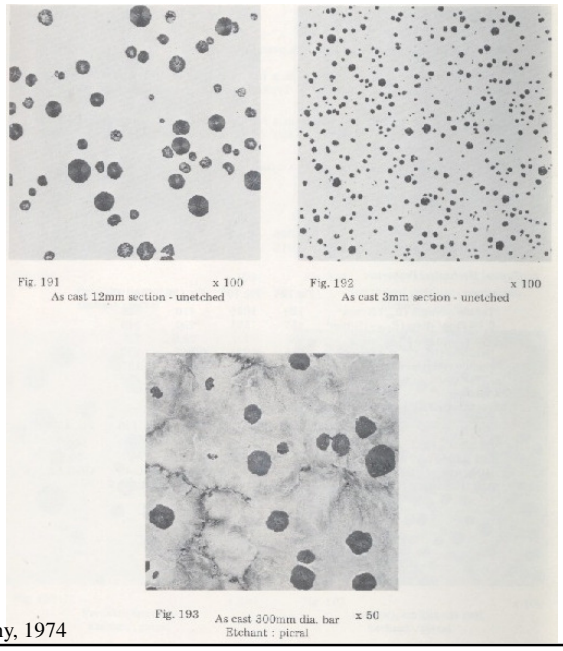


Fig. 191 x 100
As cast 12mm section - unetched

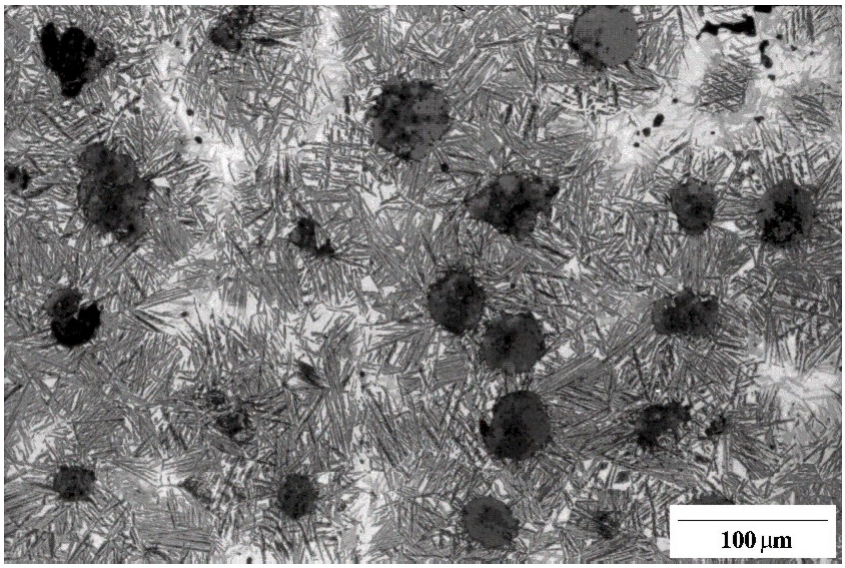
Fig. 192 x 100
As cast 3mm section - unetched

Fig. 193 As cast 300mm dia. bar x 50
Etchant : picral

30

Foundry Metallography, 1974

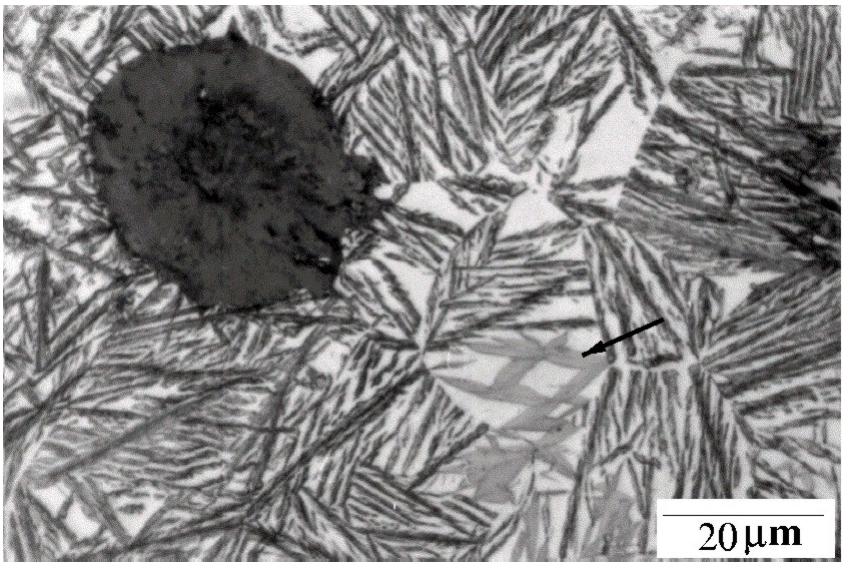
Austempered Ductile Iron (ADI)



31

http://www.doitpoms.ac.uk/miclib/index.php

Austempered Ductile Iron (ADI)



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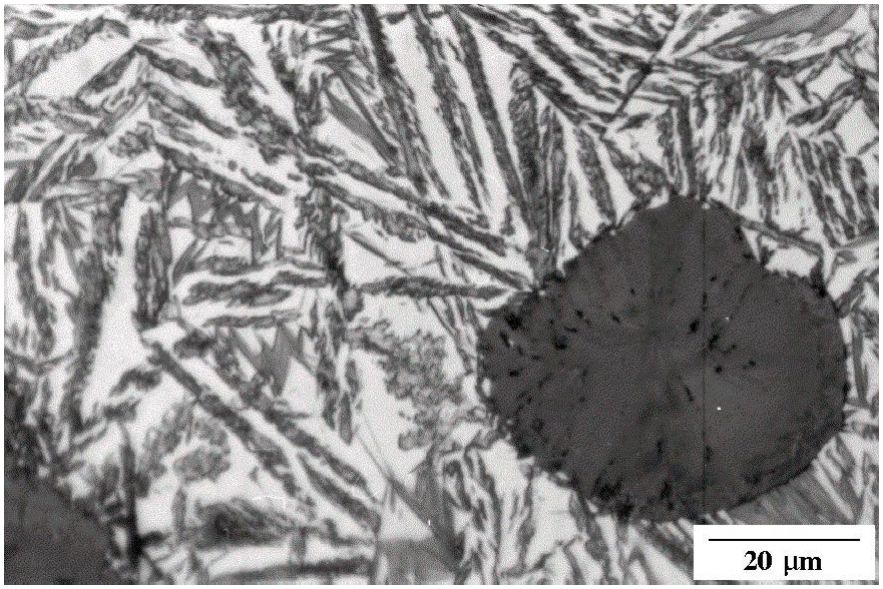
http://www.doitpoms.ac.uk/miclib/index.php

Austempered Ductile Iron (ADI)



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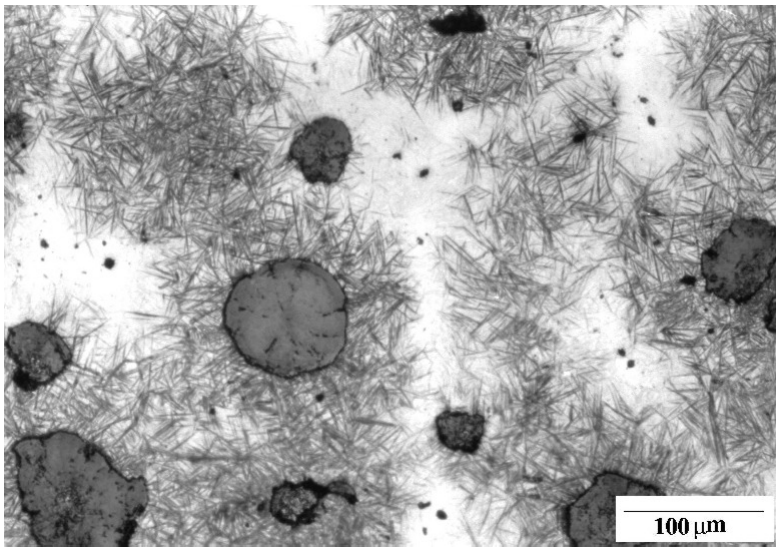
http://www.doitpoms.ac.uk/miclib/index.php

Austempered Ductile Iron (ADI)



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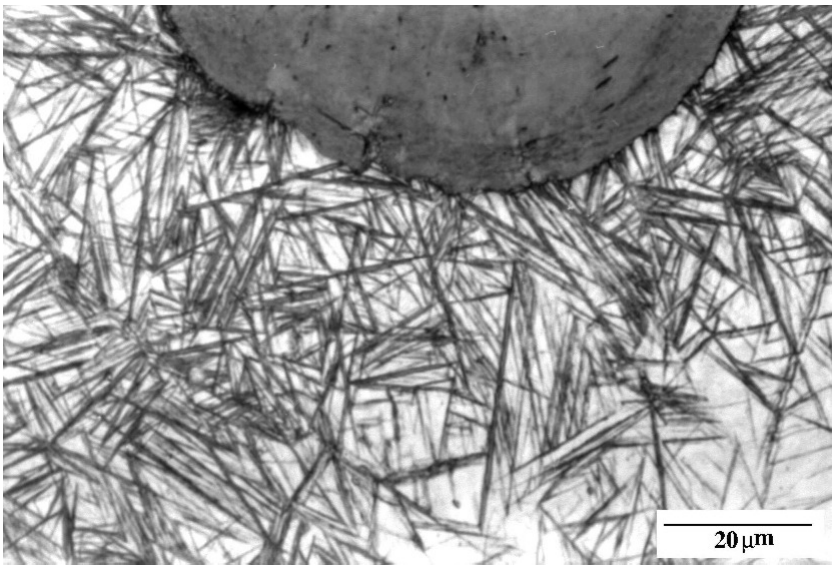
http://www.doitpoms.ac.uk/miclib/index.php

Austempered Ductile Iron (ADI)



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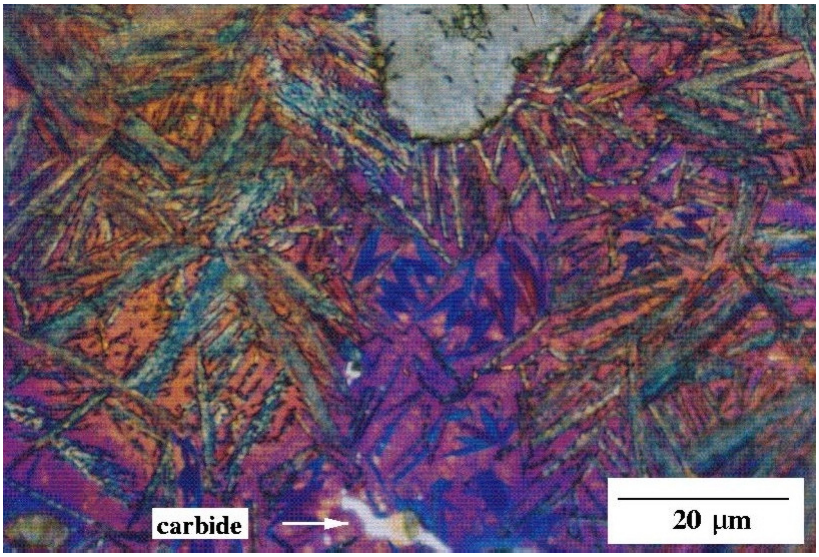
http://www.doitpoms.ac.uk/miclib/index.php

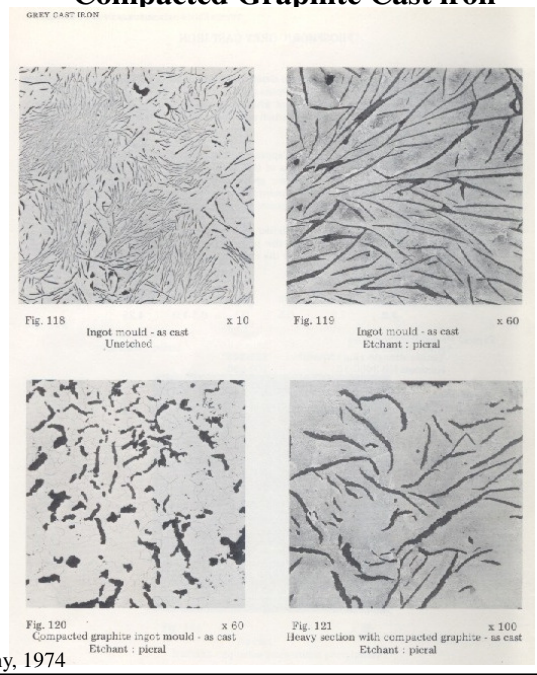
Austempered Ductile Iron (ADI)



36

http://www.doitpoms.ac.uk/miclib/index.php

Compacted Graphite Cast iron



Foundry Metallography, 1974

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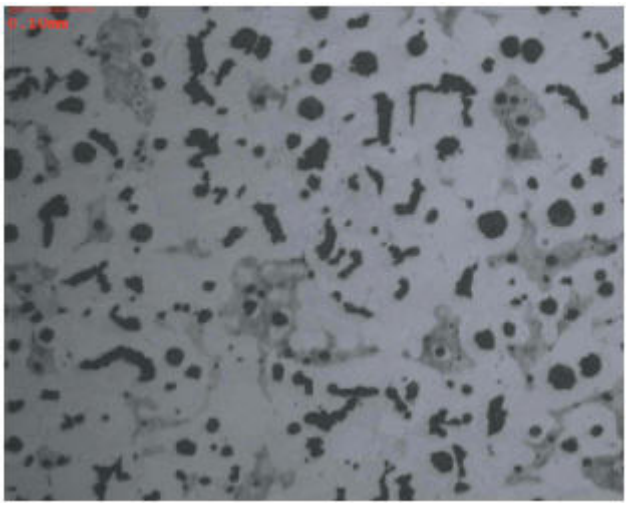
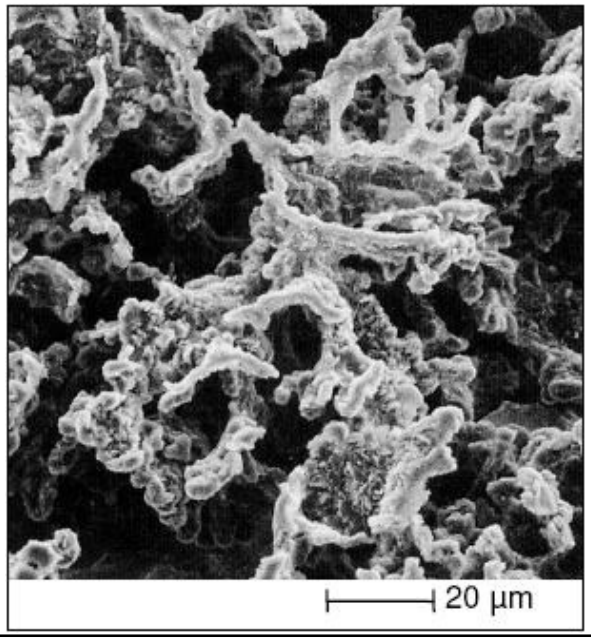
Compacted Graphite Cast iron



38

Compacted Graphite Cast iron



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Mottled Cast iron

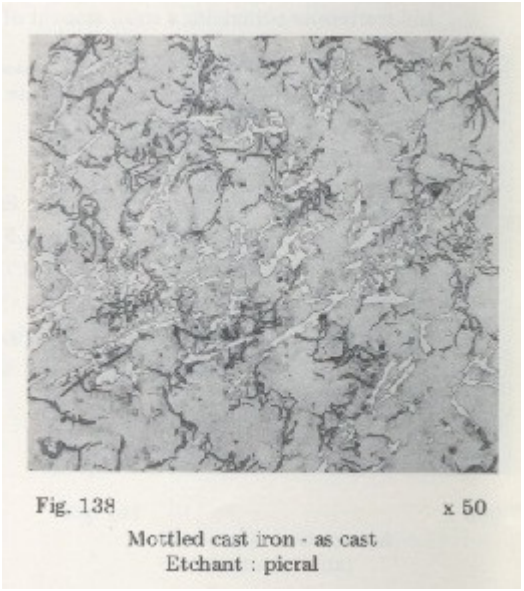
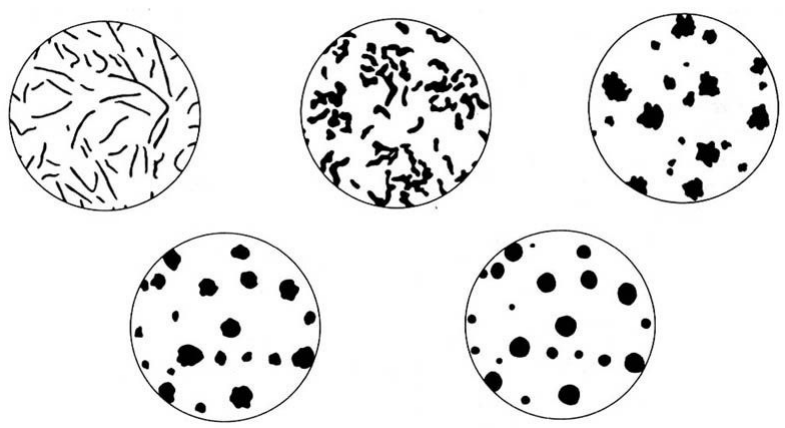


Fig. 138 x 50

Mottled cast iron - as cast
Etchant : picral

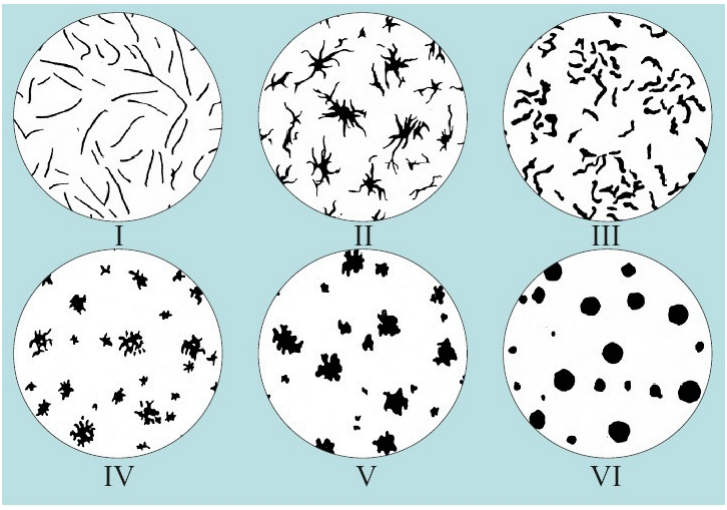
40

Foundry Metallography, 1974



Graphite types

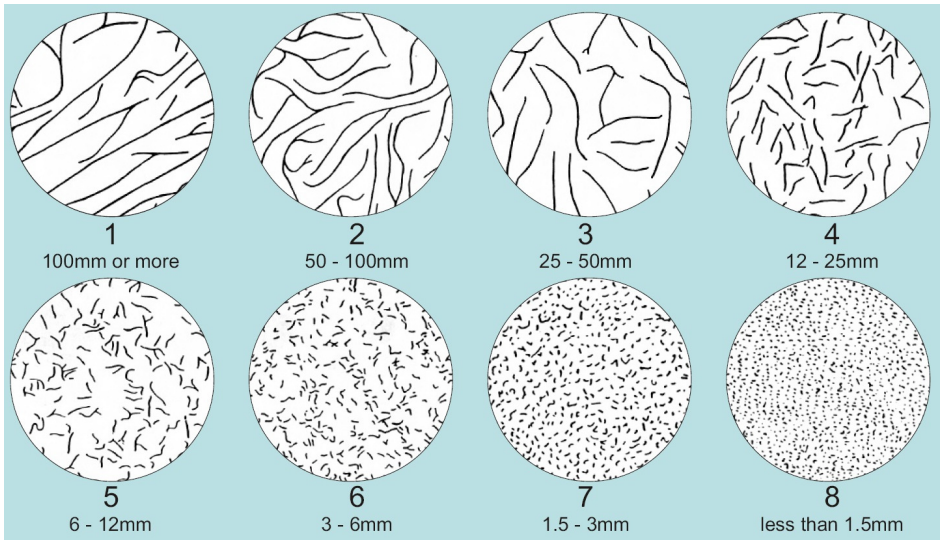
41



Different graphite types:

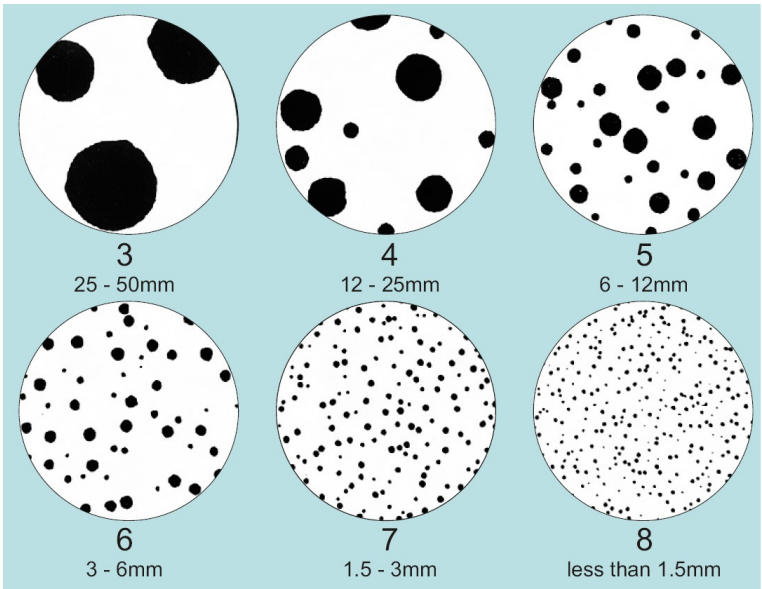
I- Flake, II- crab form, III- compacted, IV- temper, V- irregular (open) nodules and VI- nodular graphite.

42



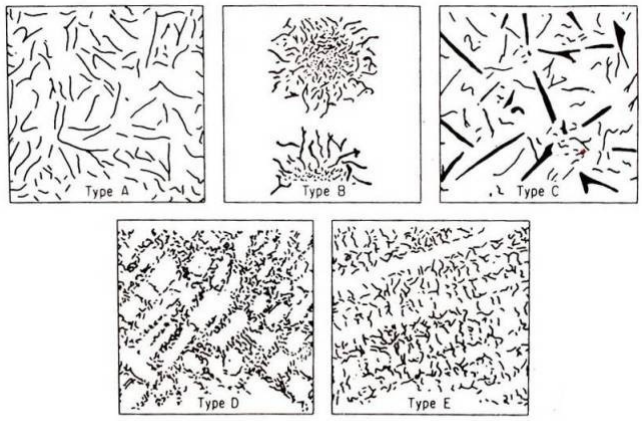
AFS and ASTM flake graphite size rating at × 100 magnification

43



AFS and ASTM nodular graphite size rating at × 100 magnification

44

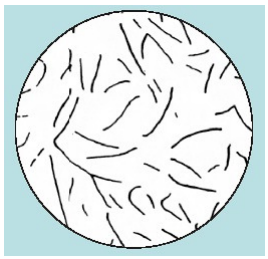


Graphite-flake Types

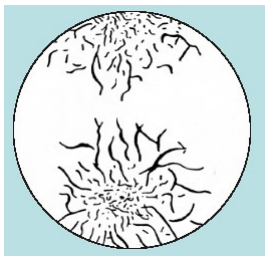
Graphite flake distributions

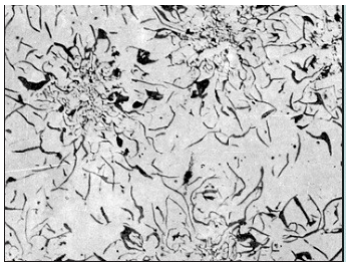
45

Graphite flake distributions



Type A

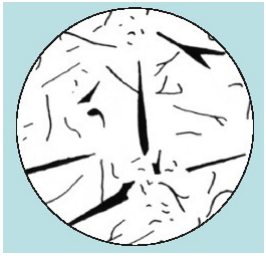




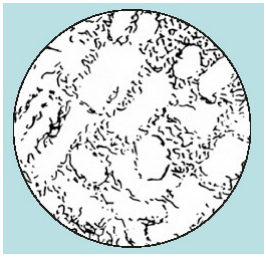
Type B

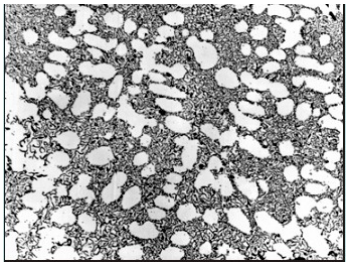
46

Graphite flake distributions



Type C

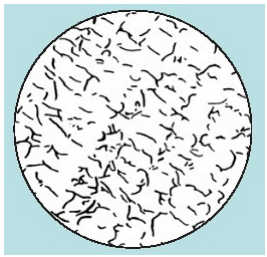


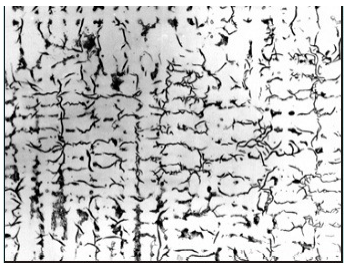


Type D

47

Graphite flake distributions

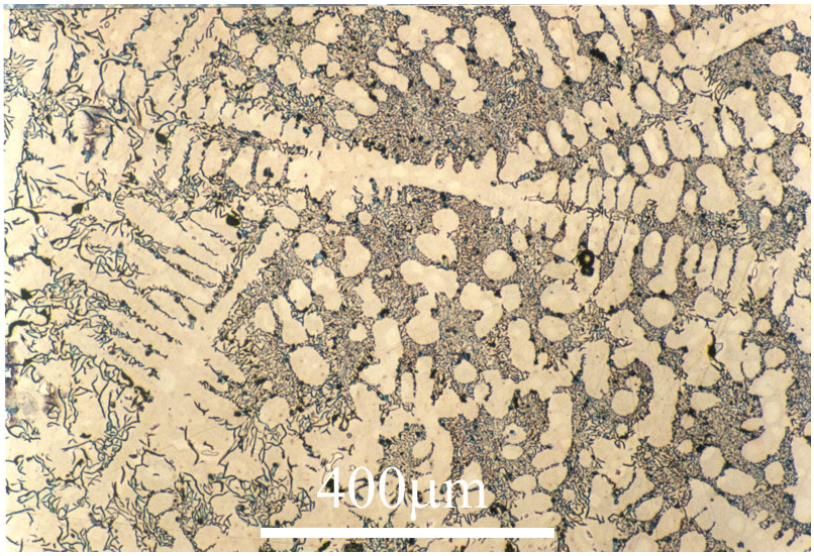




Type E

48

D type graphite in high Si cast iron



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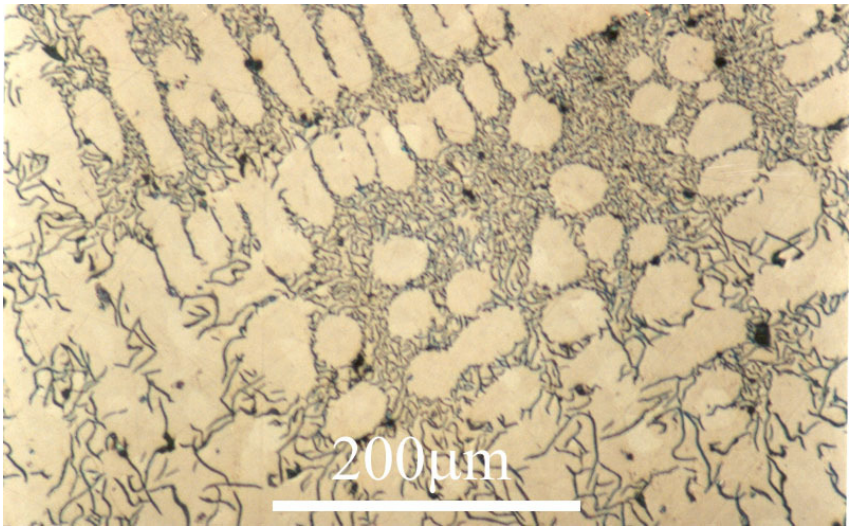
http://www.doitpoms.ac.uk/miclib/index.php

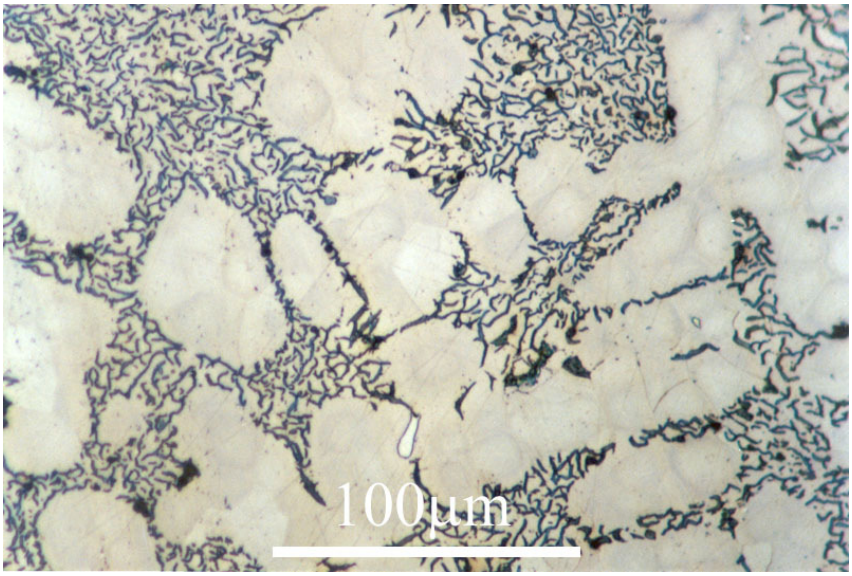
D type graphite in high Si cast iron



50

http://www.doitpoms.ac.uk/miclib/index.php

D type graphite in high Si cast iron



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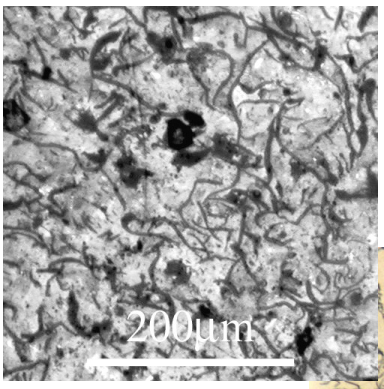
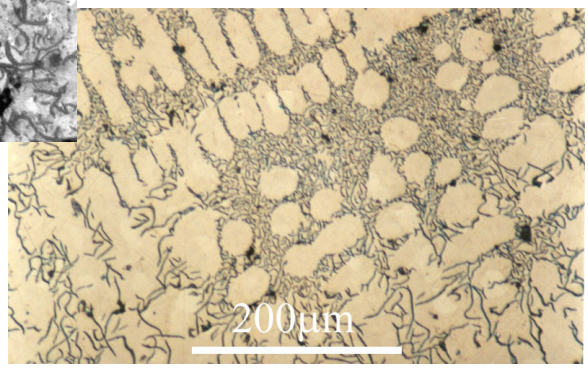
http://www.doitpoms.ac.uk/miclib/index.php

A type graphite in grey cast iron



Note that both micrographs are at a similar magnification

D type graphite in high Si cast iron



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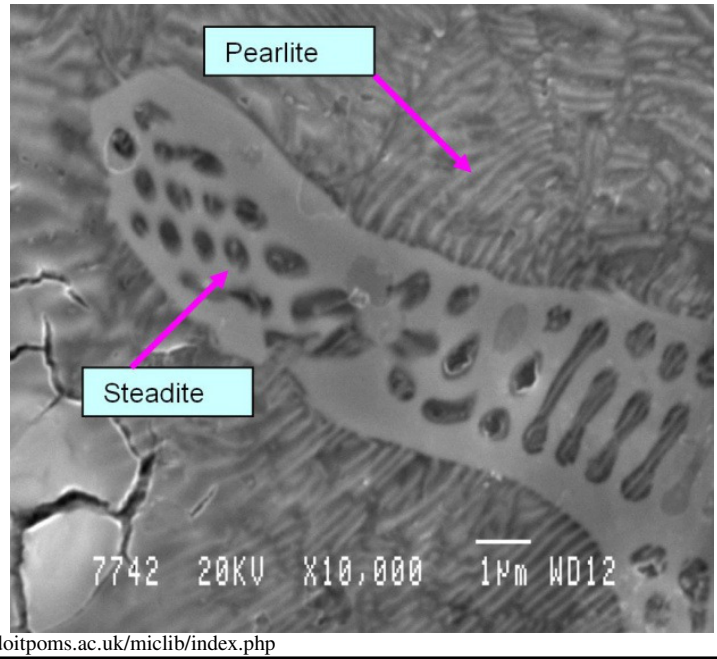
High Phosphorous cast iron



http://www.doitpoms.ac.uk/miclib/index.php

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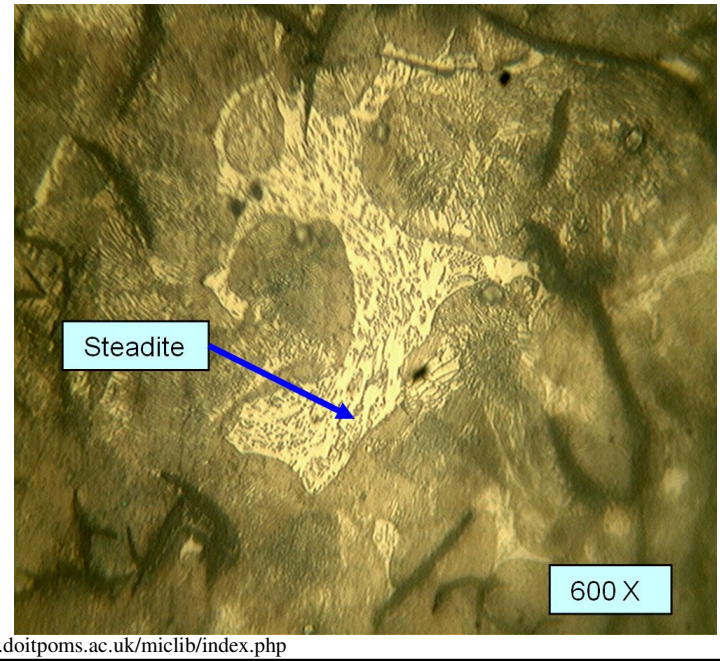
High Phosphorous cast iron



http://www.doitpoms.ac.uk/miclib/index.php

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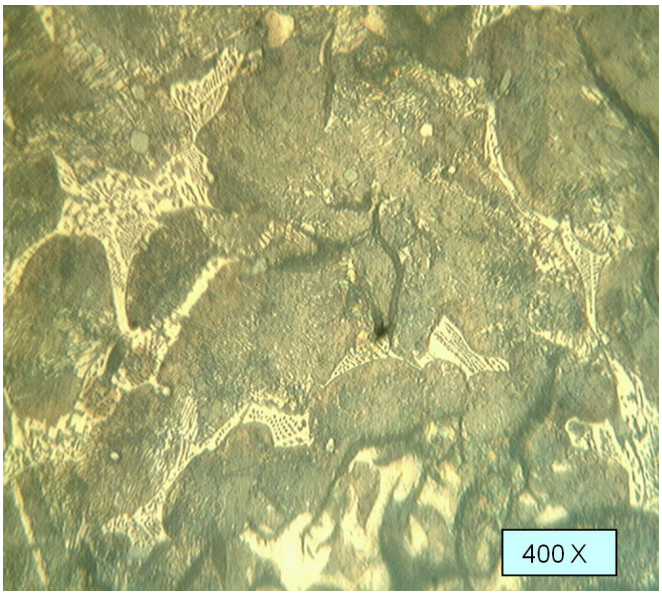
High Phosphorous cast iron



http://www.doitpoms.ac.uk/miclib/index.php

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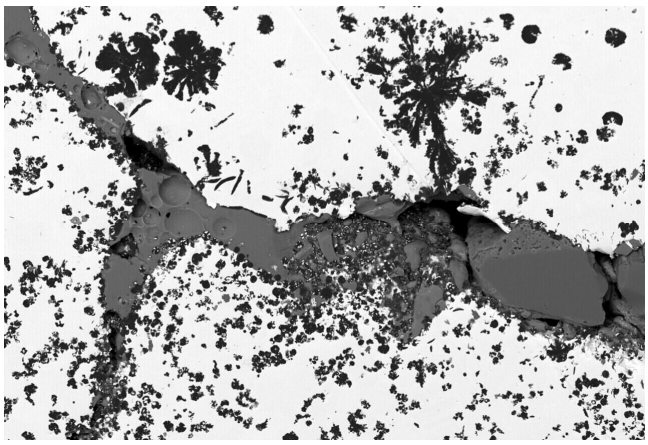
Iron sulfide in ductile iron



http://www.metals-china.com

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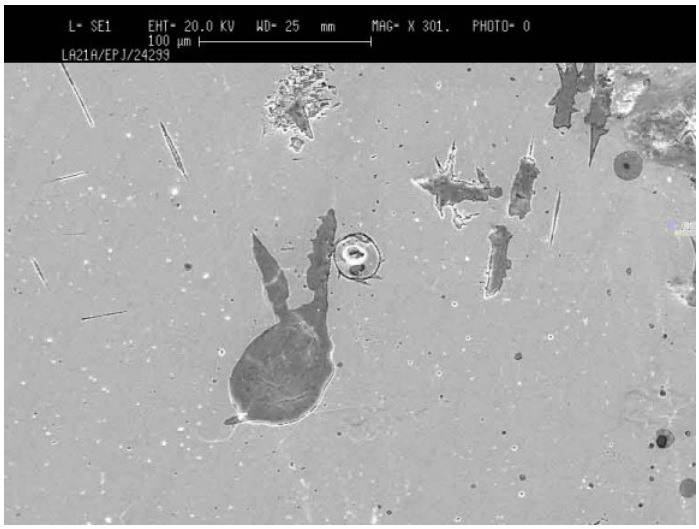
MnS inclusions of in sulfur and phosphorous-rich iron



http://www.sasaa.co.uk

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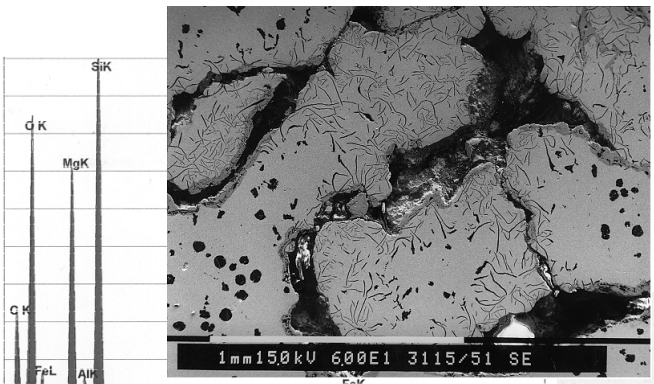
Slag inclusions



EDAX PhiRhoZ Quantification (Standardless)
Oxygen By Diff.

Element	Wt %	At %
NaK	1.10	1.05
MgK	15.67	14.24
AlK	2.89	2.37
SiK	23.89	18.80
S K	0.31	0.22
CaK	1.33	0.73
MnK	0.66	0.27
FeK	12.68	5.02
Oxygen	41.47	57.30

http://www.giessereilexikon.com