Işık Metal Mikroskobu ile

Mikro Yapı İncelemeleri

Arş. Gör. Bedri Onur KÜÇÜKYILDIRIM

Yıldız Teknik Üniversitesi

Makine Mühendisliği Bölümü

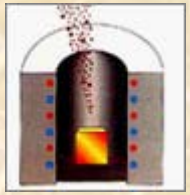
Makine Malzemesi ve İmalat Teknolojisi Anabilim Dalı

Numune Hazırlama

- Kesme
- Sıcak – Soğuk Monte
- Zımparalama
- Parlatma
- Dağlama

Kesme

Sıcak – Soğuk Monte

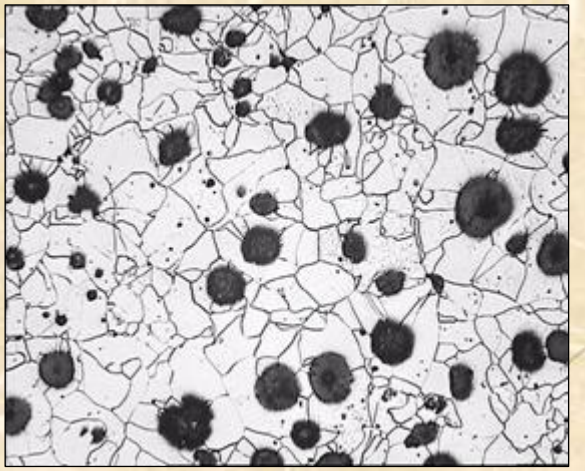


Zımparalama

Parlatma

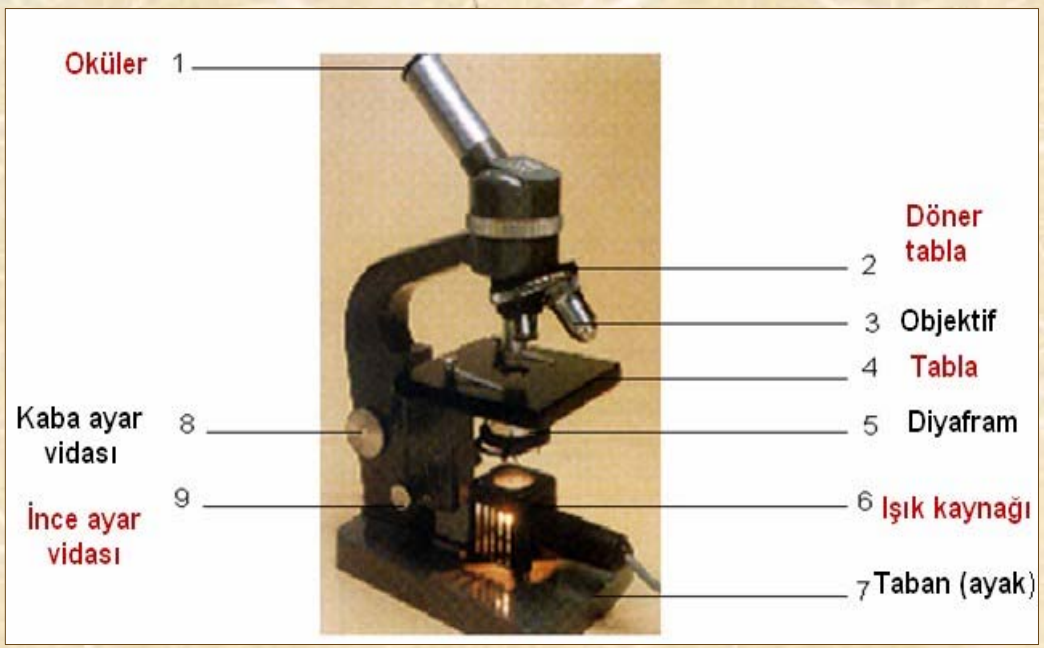
Arctic Alumina
Thermal Adhesive
Thermal Adhesive
5 Minute 1:1
PART B

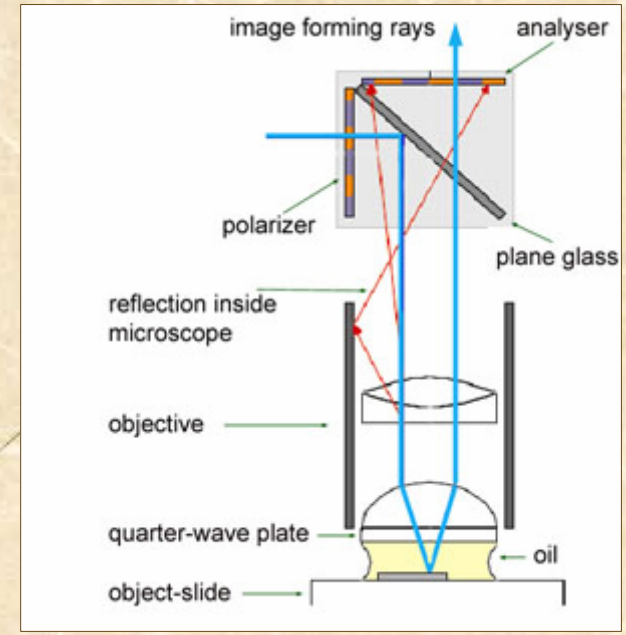
Dağlama



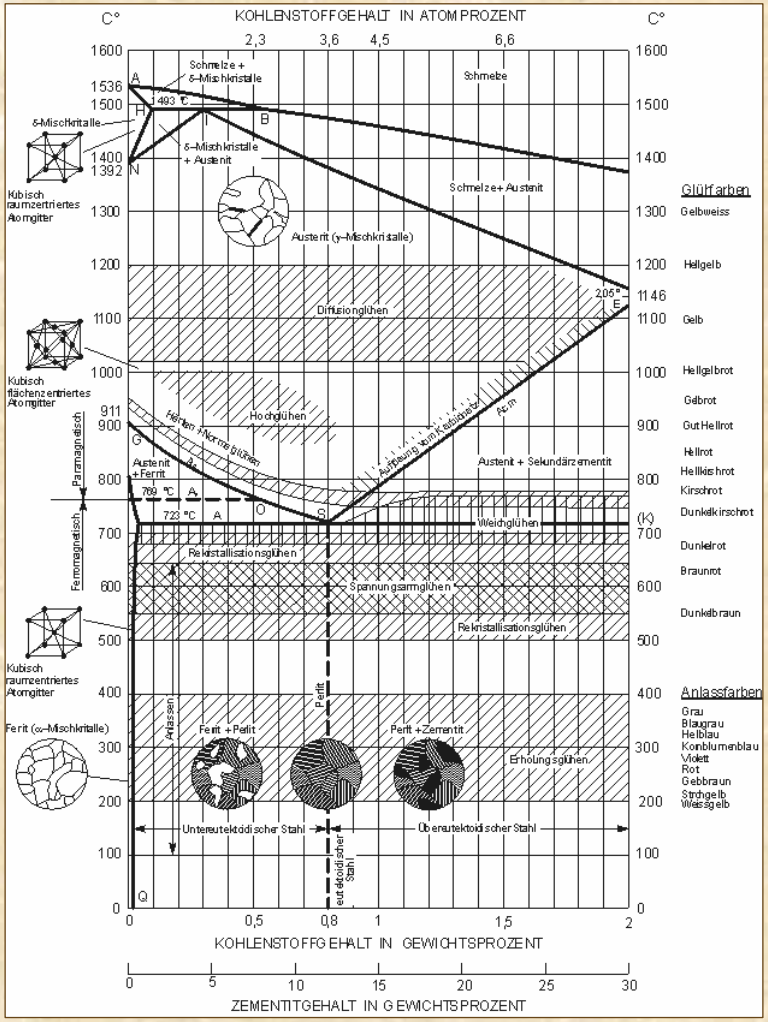
Alaşımsız küresel grafitli dökme demirin
dökülmüş haldeki mikroyapısı, (Dağlama %2 Nital)

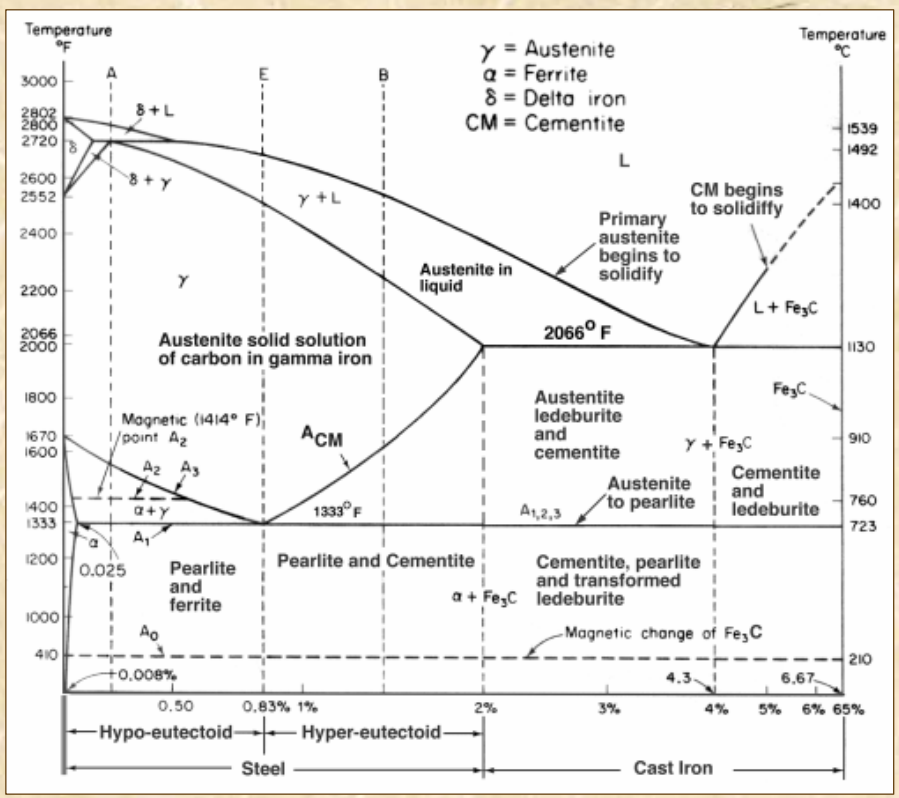
Işık Metal Mikroskobu

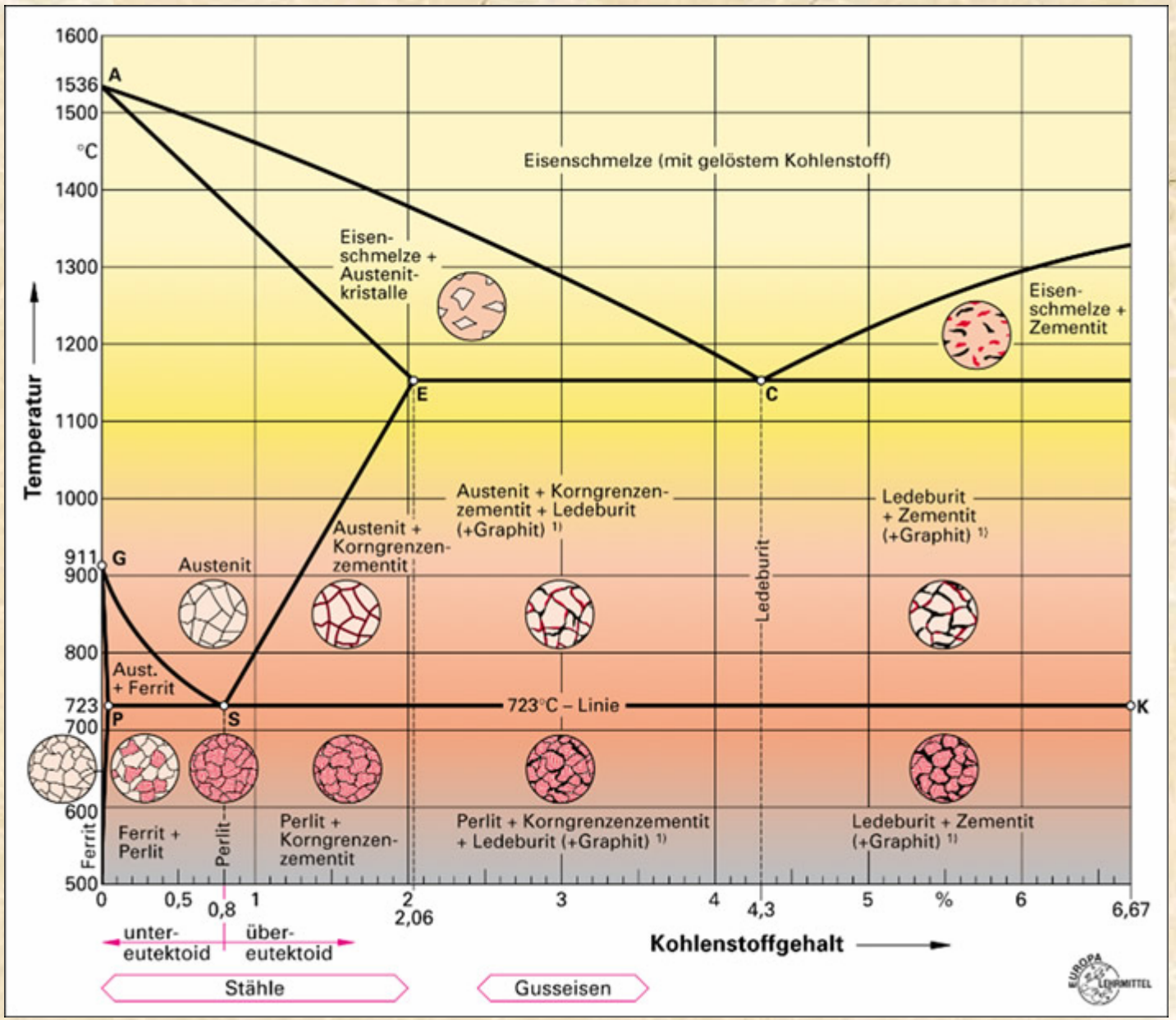




Çelik ve Dökme Demir Mikro Yapıları





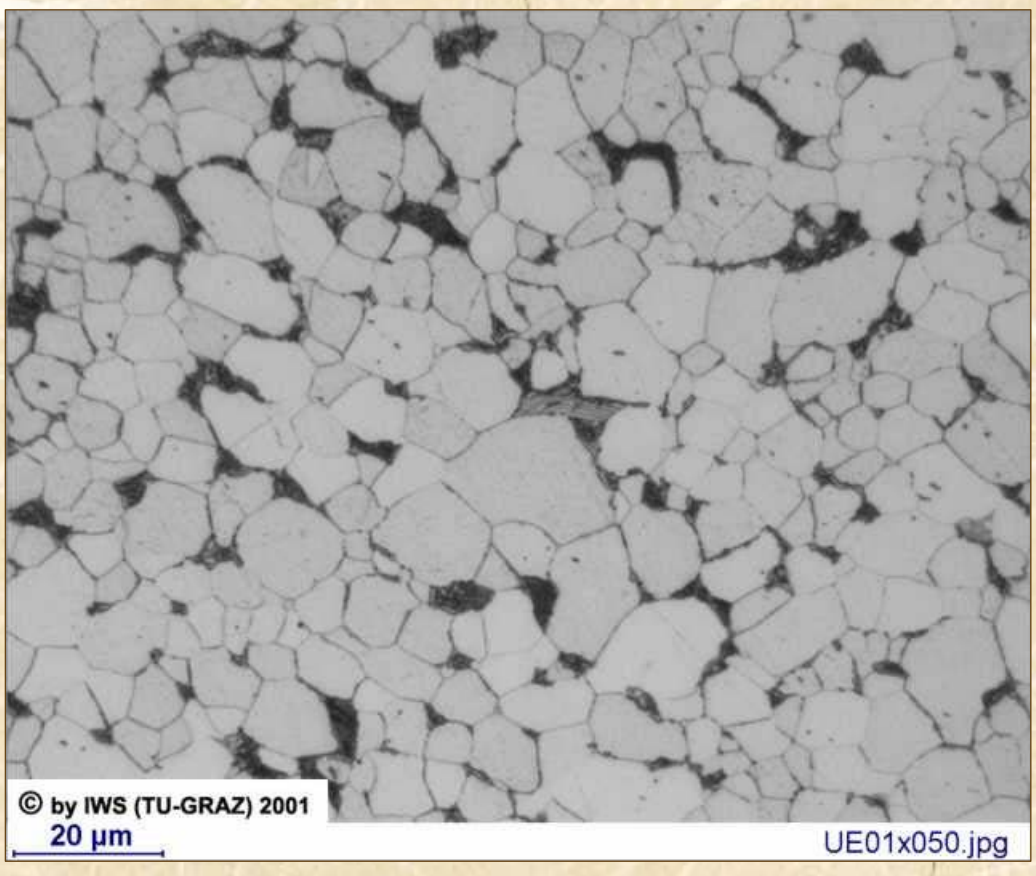

1600
1536
1500
°C
1400
1300
1200
1100
1000
911
900
800
723
700
600
500
Temperatur
A
G
P
S
E
C
K
Eisenschmelze (mit gelöstem Kohlenstoff)
Eisen-
schmelze +
Austenit-
kristalle
Eisen-
schmelze +
Zementit
Austenit
Austenit +
Korngrenzen-
zementit
Austenit + Korngrenzen-
zementit + Ledeburit
(+Graphit) 1)
Ledeburit
Ledeburit
+ Zementit
(+Graphit) 1)
Aust.
+ Ferrit
723°C – Linie
Ferrit
Ferrit +
Perlit
Perlit
Perlit +
Korngrenzen-
zementit
Perlit + Korngrenzenzementit
+ Ledeburit (+Graphit) 1)
Ledeburit + Zementit
(+Graphit) 1)
0
0,5
0,8
1
2
2,06
3
4
4,3
5
%
6
6,67
unter-
eutektoid
über-
eutektoid
Kohlenstoffgehalt
Stähle
Gusseisen

α-Ferrit

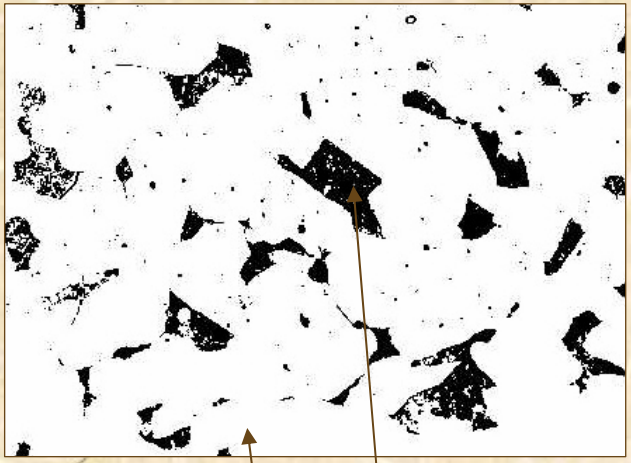
Ferrit + 3. Sementit

Ferritik yapı

Ferrit + Perlit

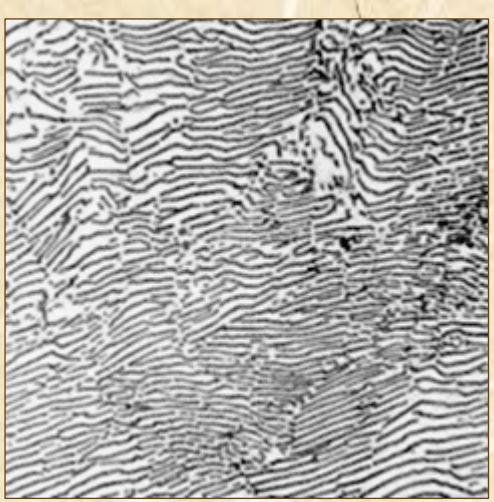


Ferrit + Perlit



Ferrit + Perlit

Perlit

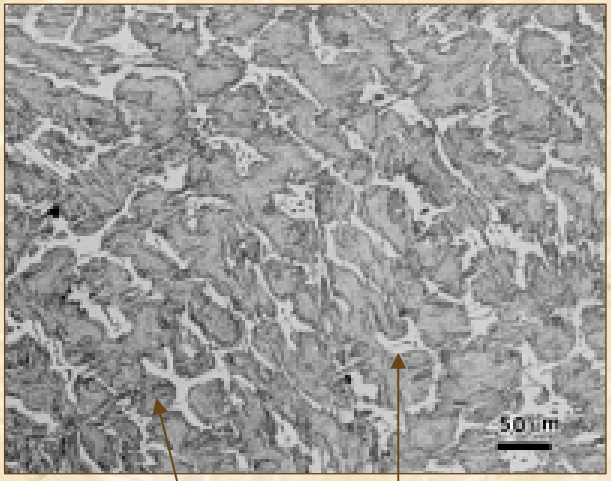


Perlit

Perlit

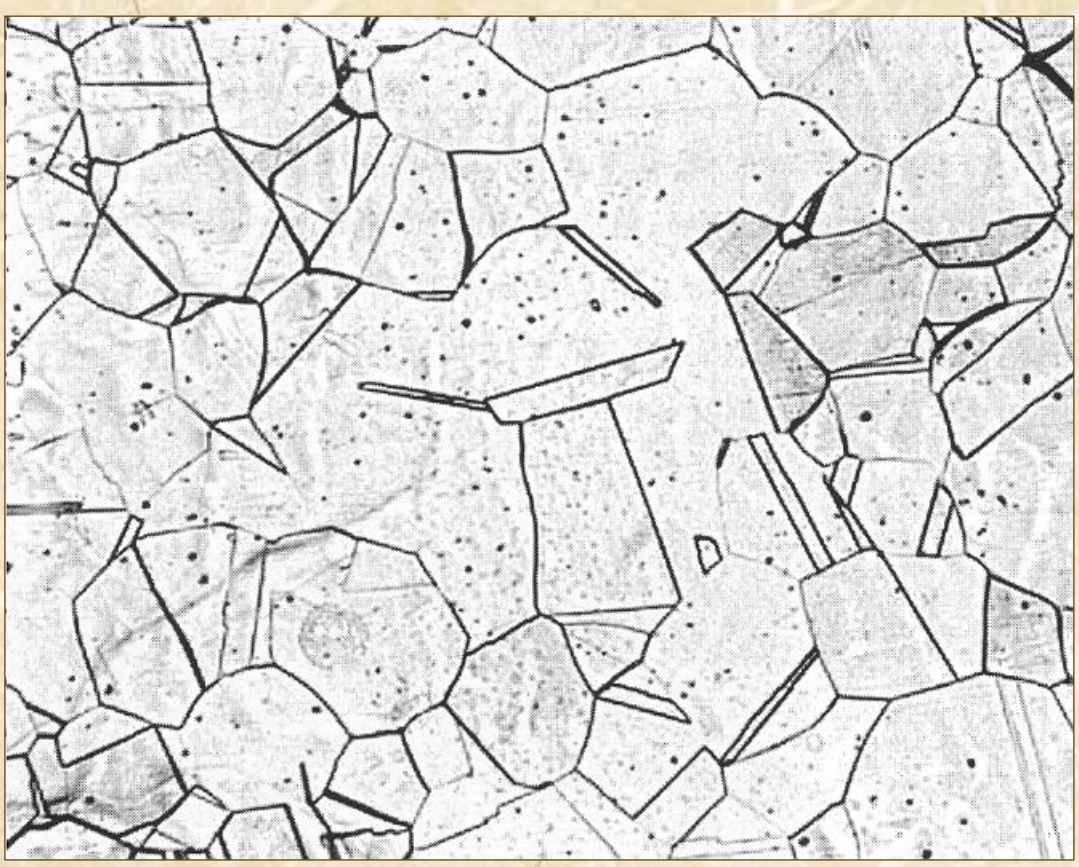
Perlit + 2.sementit

Perlit + 2. Sementit

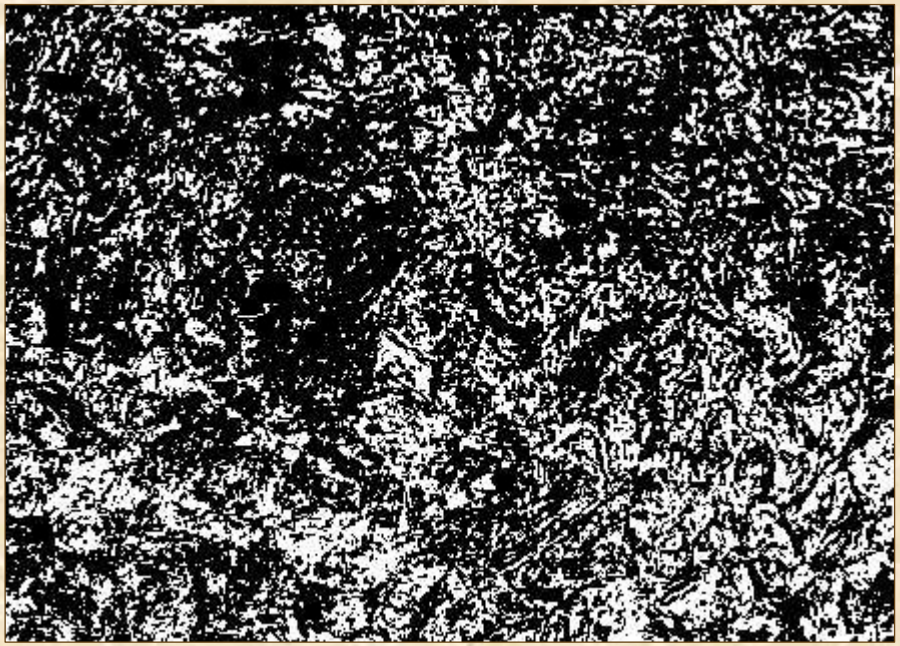


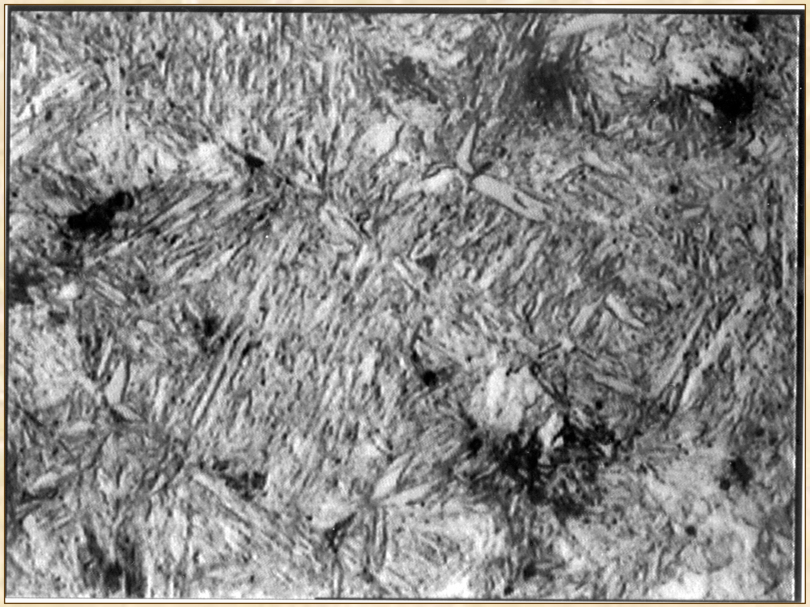
Perlit + 2. Sementit

Östenit

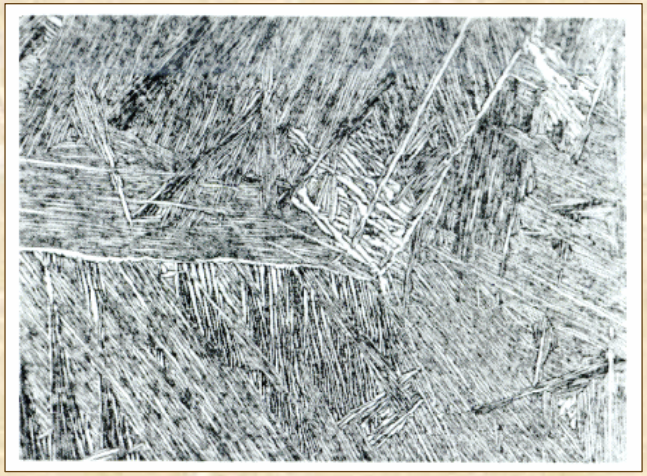


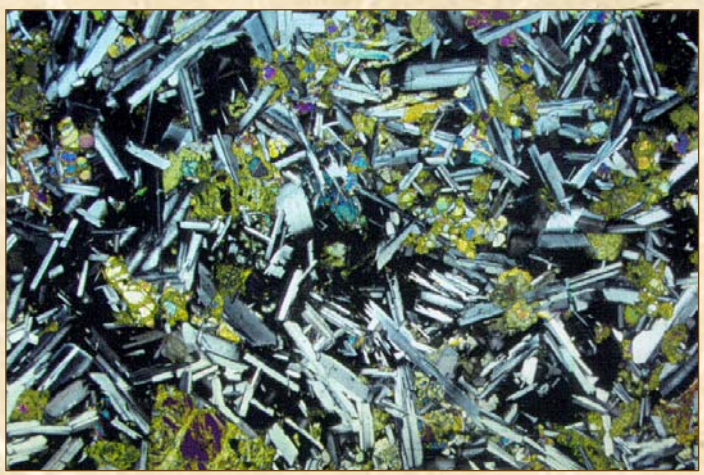
Martenzit

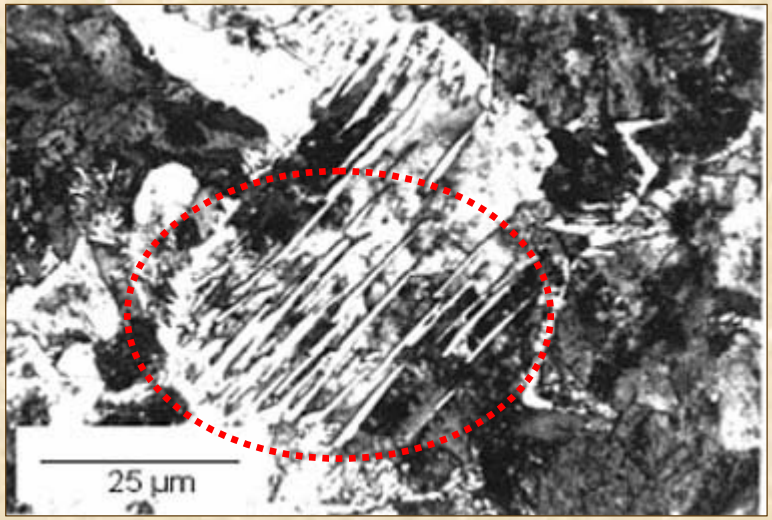




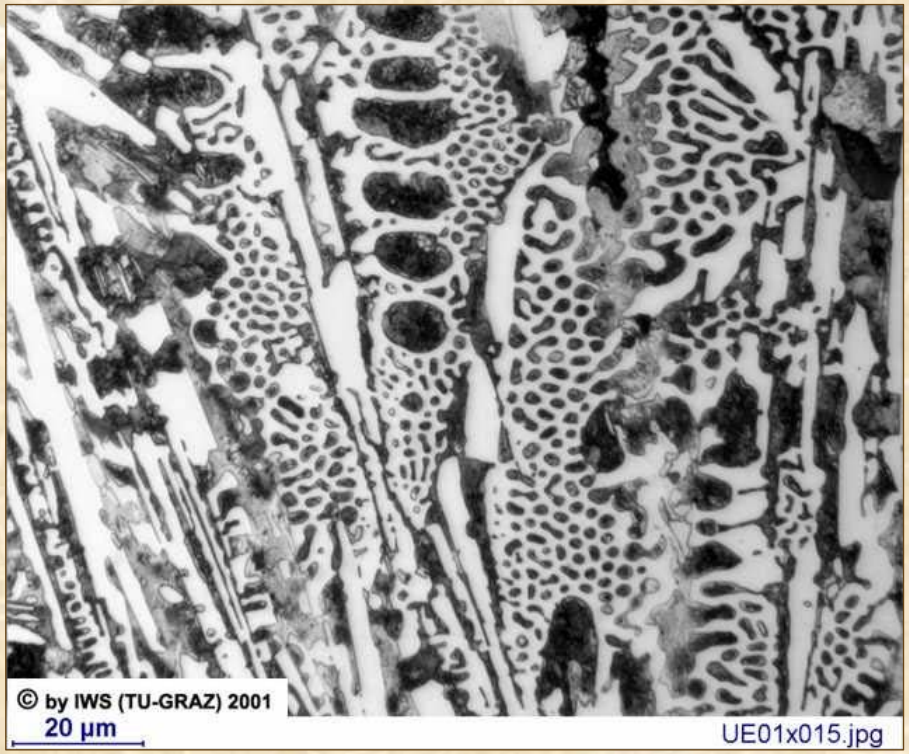
Widmanstätten







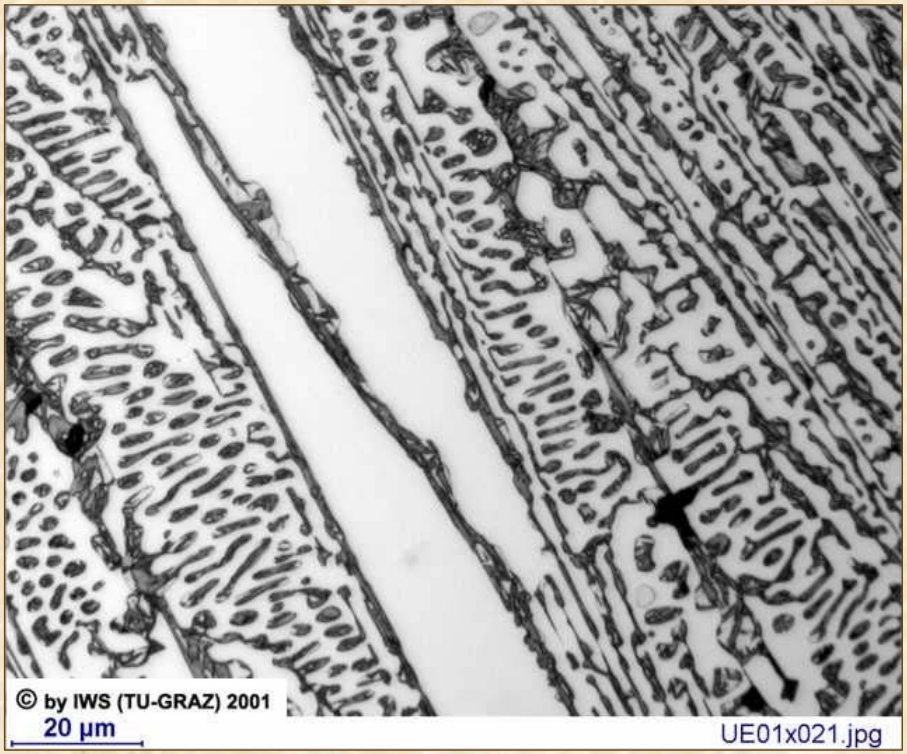
Perlit + 2. Sementit + Ledeburit



Perlit + 1. Sementit + Ledeburit

Ledeburit

1. sementit



Dökme Demirler

- Lamel grafitli
- Küresel Grafitli

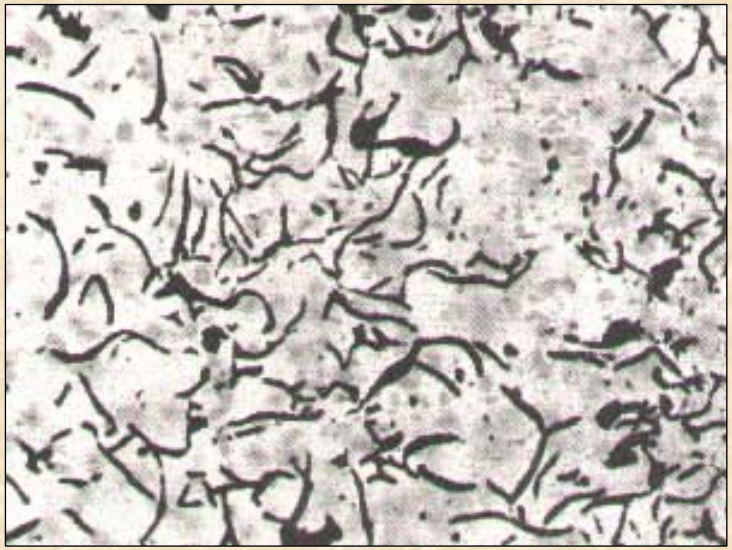
} Dağlanmadan bakıldığında

- Ferritik
- Ferritik+Perlitik
- Perlitik

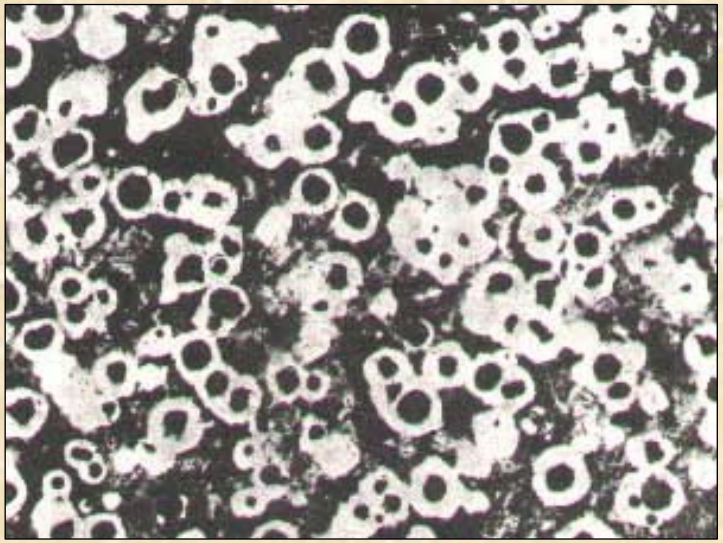
} Dağlanıp bakıldığında

- Östenitik

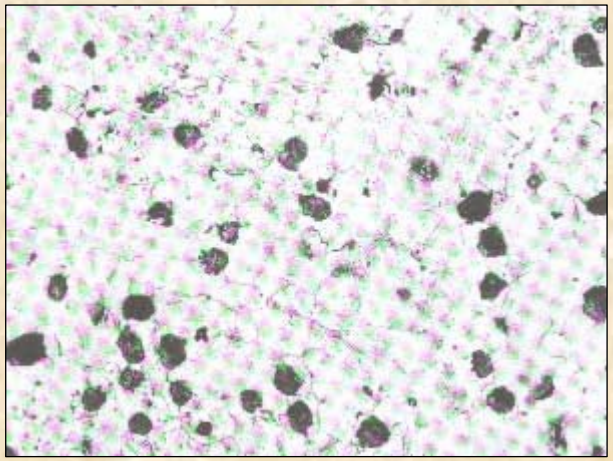
Grafitler



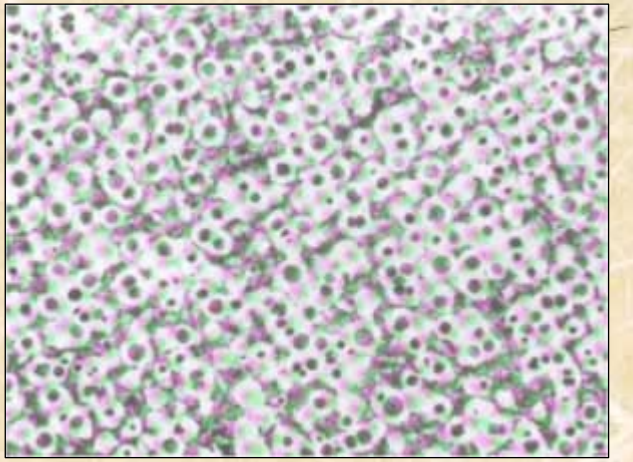
LAMEL GRAFİTLİ DÖKME DEMİR MİKRO YAPISI



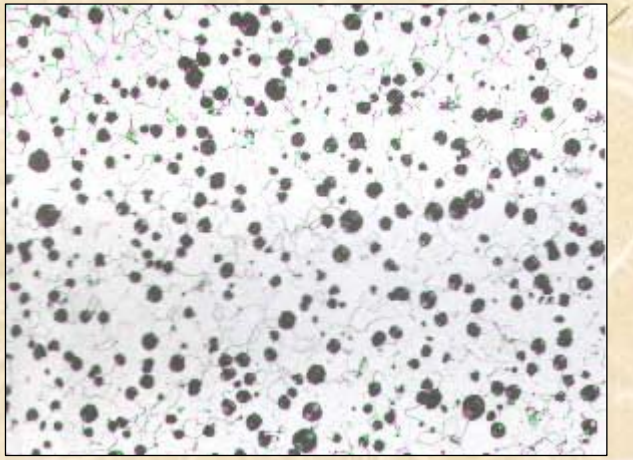
KÜRESEL GRAFİTLİ DÖKME DEMİR MİKRO YAPISI



Ferritik

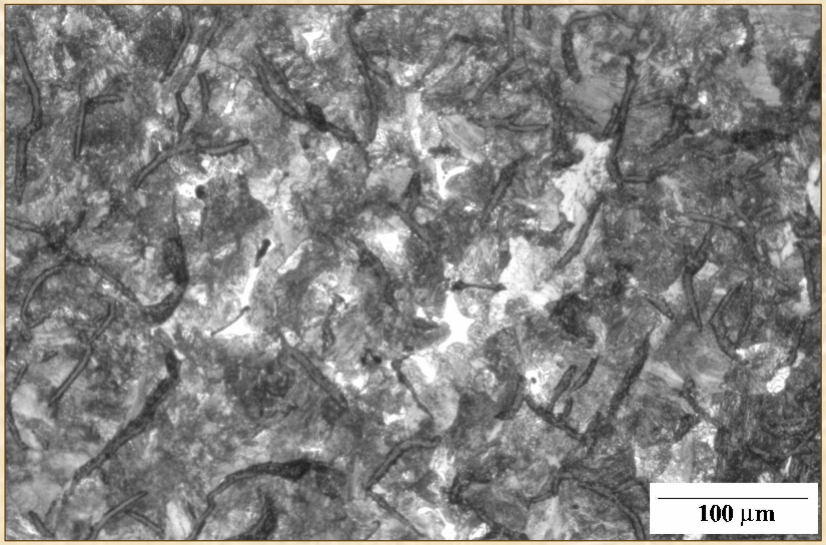


Perlitik

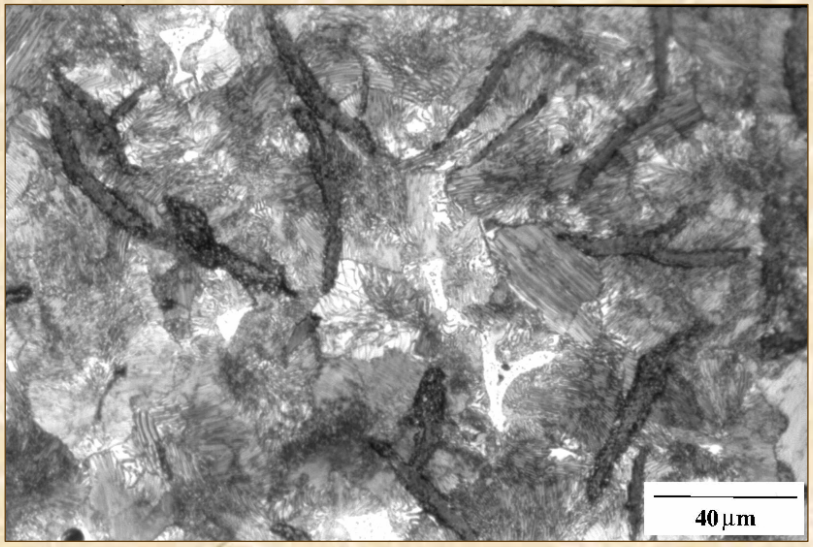


Östenitik

Mikro Yapılar

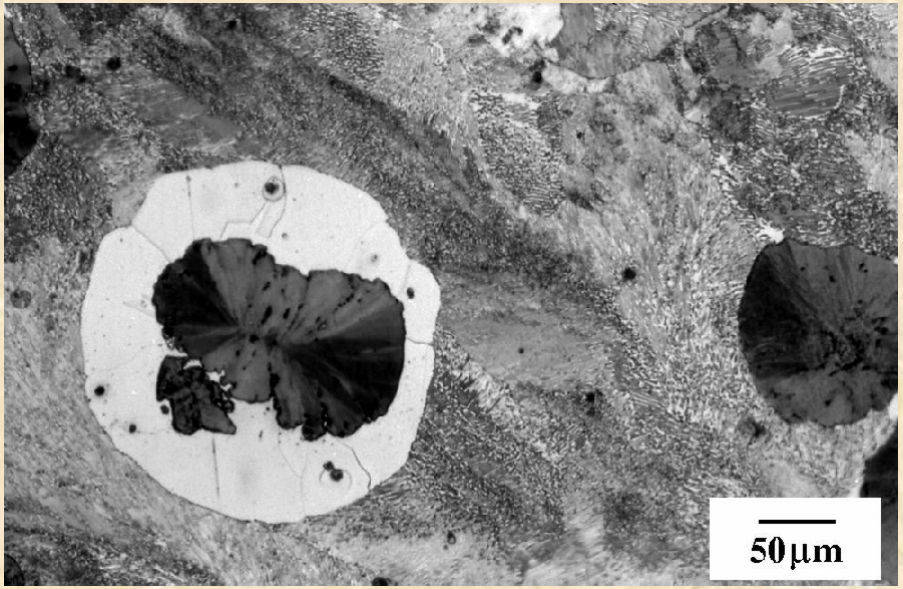


Grey cast iron, Fe-3.2C-2.5Si wt%, containing graphite flakes in a matrix which is pearlitic. The speckled white regions represent a phosphide eutectic. Etchant: Nital 2%



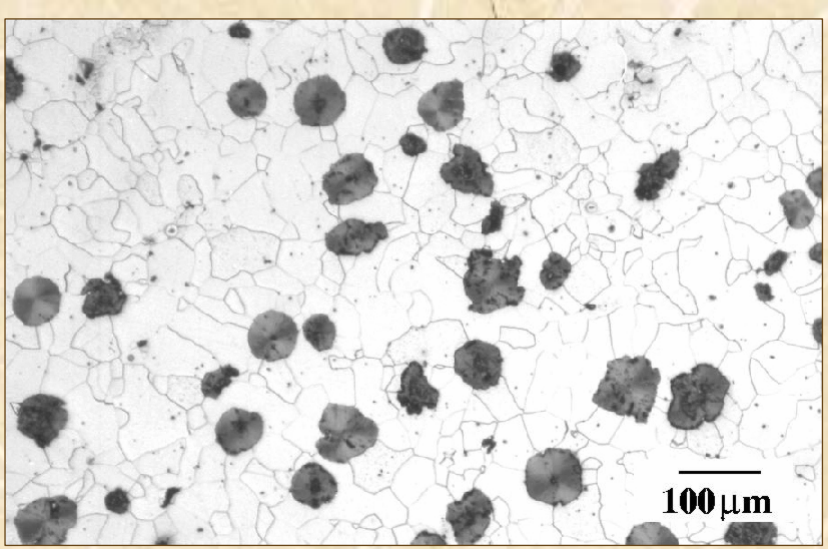
Grey cast iron, Fe-3.2C-2.5Si wt%, containing graphite flakes in a matrix which is pearlitic. The lamellar structure of the pearlite can be resolved, appearing to consist of alternating layers of cementite and ferrite. The speckled white regions represent a phosphide eutectic. Etchant: Nital 2%

Mikro Yapılar

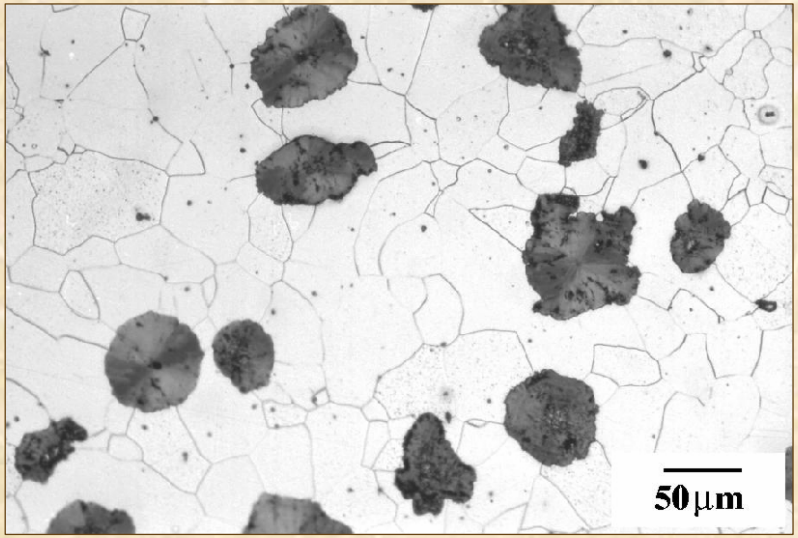


Spheroidal graphite cast iron, Fe-3.2C-2.5Si-0.05Mg wt%, containing graphite nodules in a matrix which is pearlitic. One of the nodules is surrounded by ferrite, simply because the region around the nodule is decarburised as carbon deposits on to the graphite. Etchant: Nital 2%

Mikro Yapılar

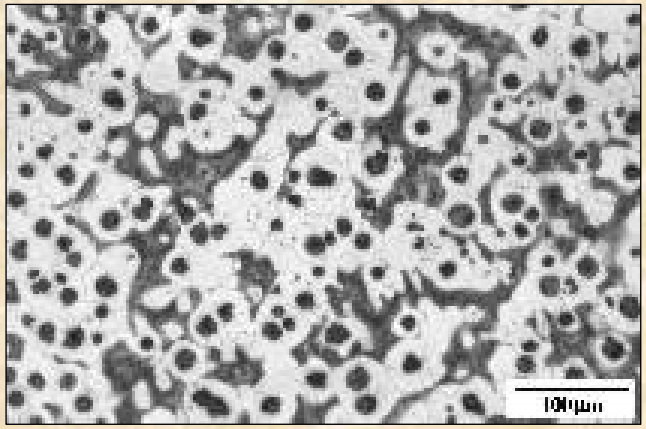


Graphite nodules in a ferritic matrix

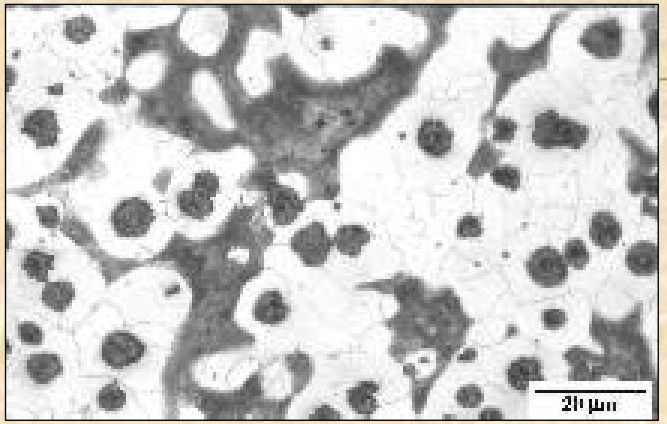


Graphite nodules in a ferritic matrix. Some carbon deposited during tempering is also visible. Etchant: Nital 2%

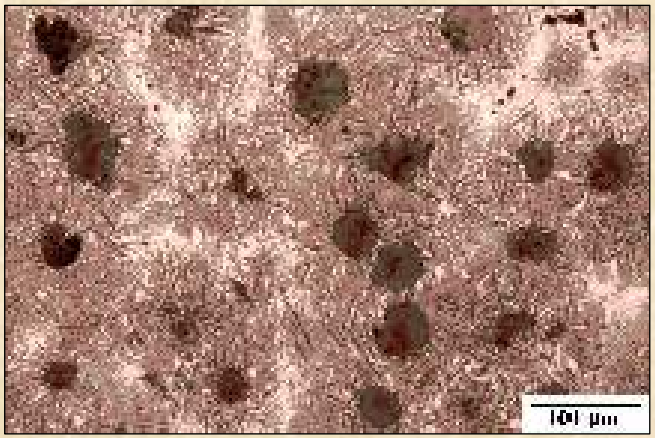
Mikro Yapılar



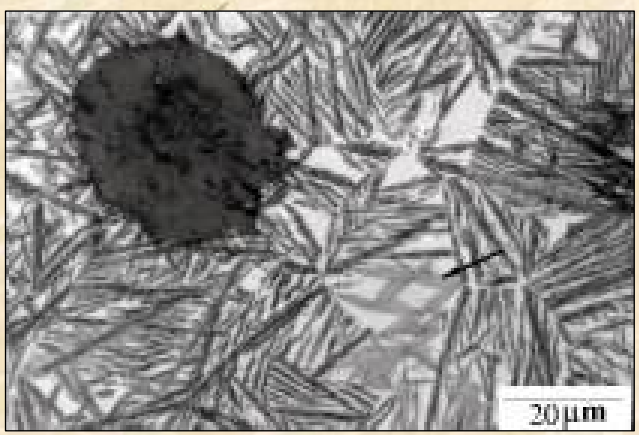
Ductile iron as-cast. Nodules of graphite, pearlite (dark islands) and ferrite (light background). Etchant: Nital 2%



Ductile iron as-cast. Nodules of graphite, pearlite (dark islands) and ferrite (light background). Etchant: Nital 2%

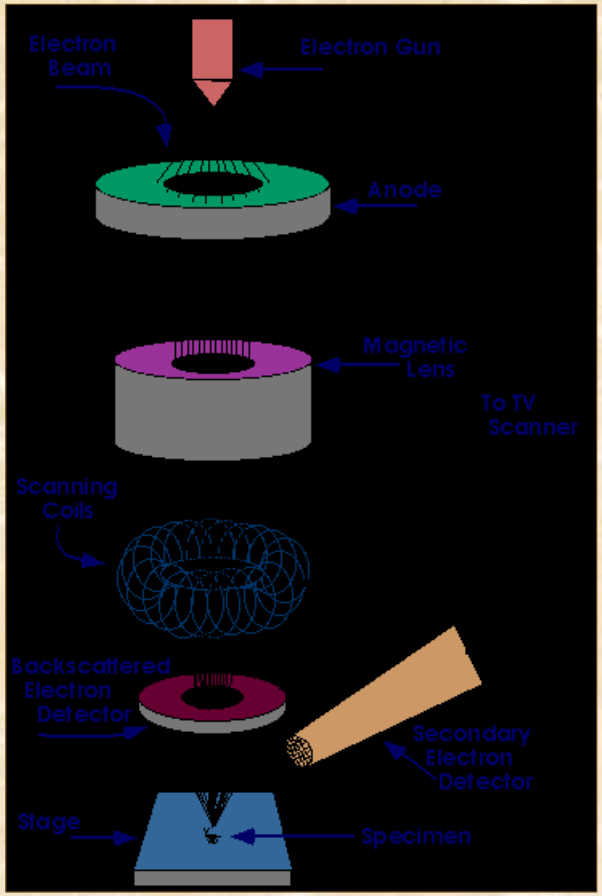


Austenitised 950°C, austempered 350°C for 64 min.

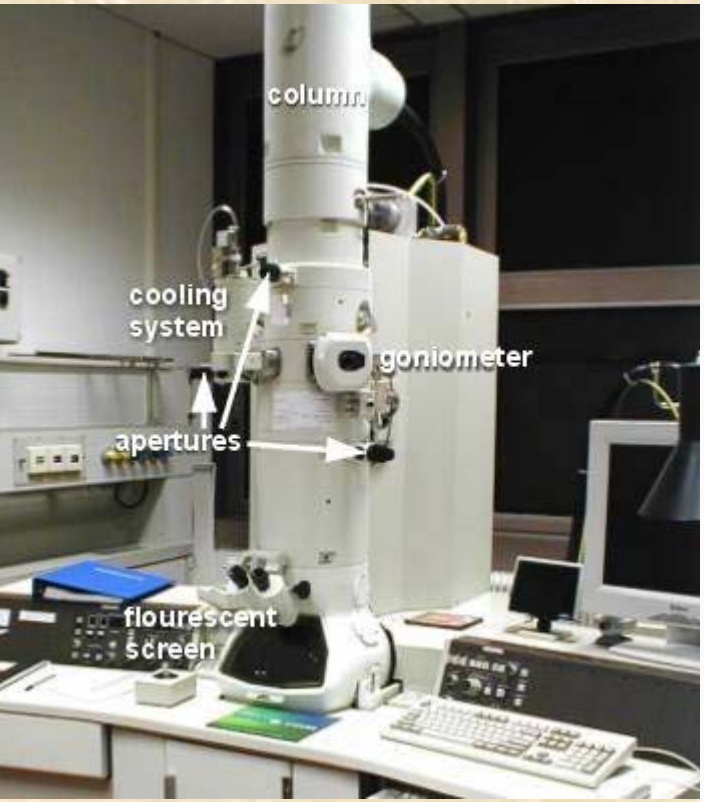


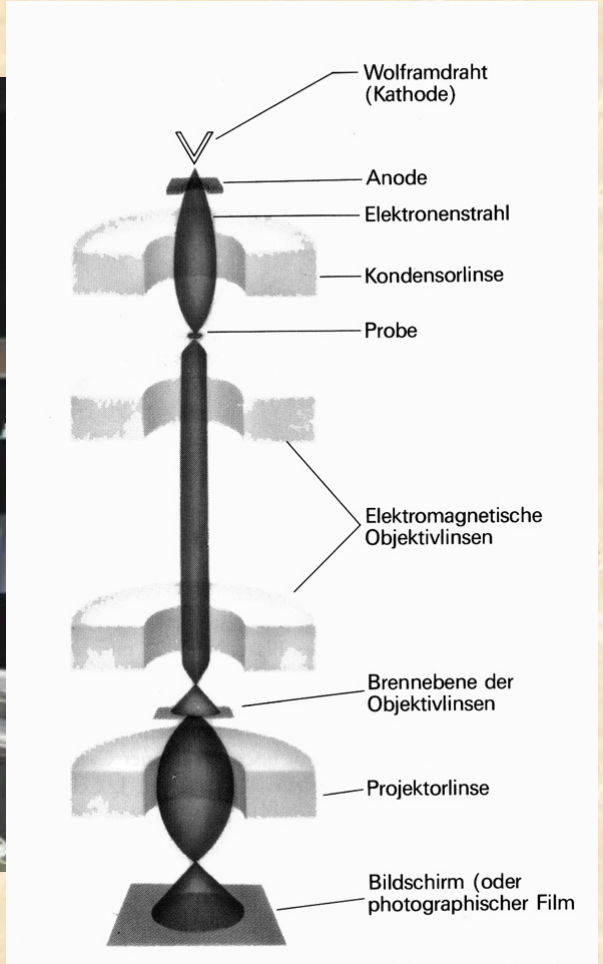
Austenitised at 950°C, austempered at 350°C for 64 min.

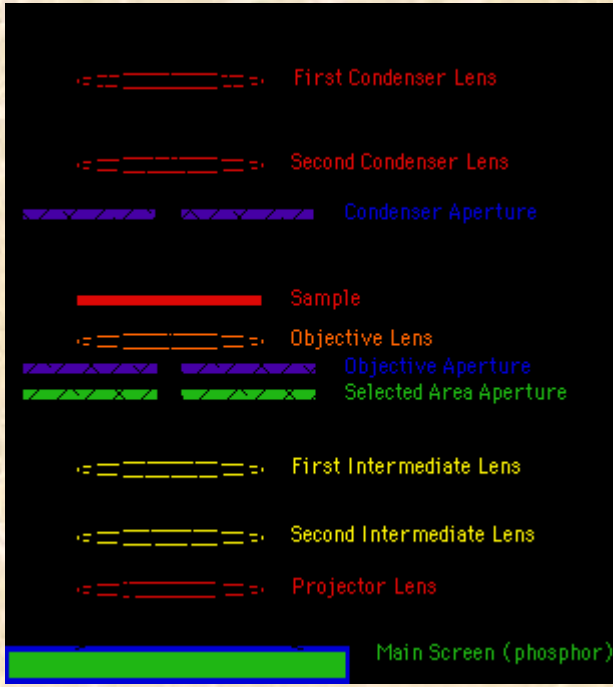
SEM


Electron Beam
Electron Gun
Anode
Magnetic Lens
To TV Scanner
Scanning Coils
Backscattered Electron Detector
Secondary Electron Detector
Stage
Specimen

TEM

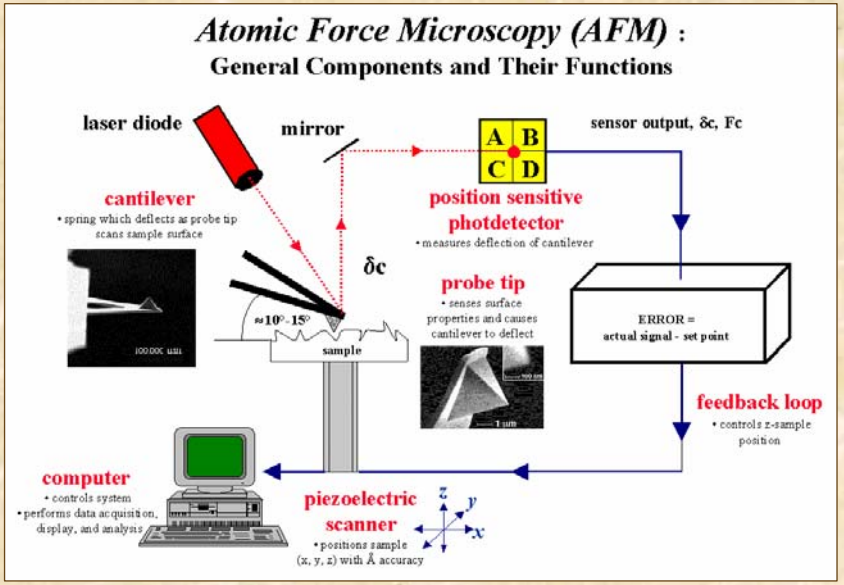

column
cooling system
goniometer
apertures
flourescent screen

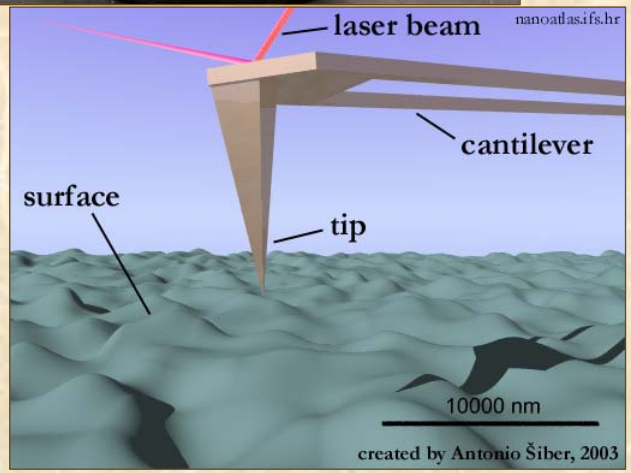

Wolframdraht (Kathode)
Anode
Elektronenstrahl
Kondensorlinse
Probe
Elektromagnetische Objektivlinsen
Brennebene der Objektivlinsen
Projektorlinse
Bildschirm (oder photographischer Film

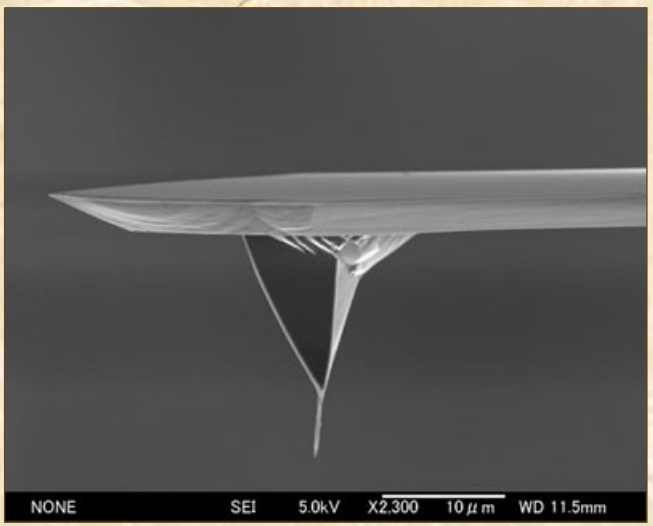

First Condenser Lens
Second Condenser Lens
Condenser Aperture
Sample
Objective Lens
Objective Aperture
Selected Area Aperture
First Intermediate Lens
Second Intermediate Lens
Projector Lens
Main Screen (phosphor)

AFM

PicoForce
Digital Instruments
10.73
-143


Atomic Force Microscopy (AFM) :
General Components and Their Functions
laser diode
mirror
sensor output, δc, Fc
A B
C D
cantilever
• spring which deflects as probe tip scans sample surface
position sensitive photdetector
• measures deflection of cantilever
δc
probe tip
• senses surface properties and causes cantilever to deflect
≈10°-15°
sample
ERROR =
actual signal - set point
feedback loop
• controls z-sample position
computer
• controls system
• performs data acquisition, display, and analysis
piezoelectric scanner
• positions sample (x, y, z) with Å accuracy
z
y
x


laser beam
nanoatlas.ifs.hr
cantilever
surface
tip
10000 nm
created by Antonio Šiber, 2003


NONE
SEI
5.0kV
X2,300
10 μm
WD 11.5mm

Yararlanılabilecek web adresleri

- http://iws.tugraz.at
- http://www.msm.cam.ac.uk/phase-trans/2001/adi/cast.iron.html
- http://www.imwf.uni-stuttgart.de/lehre/vd/wkp/07_Dilatometer_ZTU/Dilatometer_ZTU.htm
- http://www.tf.uni-kiel.de/matwis/amat/mw1_ge/kap_8/backbone/r8_4_1.html
- http://www.msm.cam.ac.uk/phase-trans/2001/adi/cast.iron.html
- http://www.istikamet.com.tr/tr/teknikbilgiler.asp?kurumsal=3