

Morphological Study of bainite in 0.7 Mass pct Fe-C alloy

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Morphology of grain boundary nucleated ferrite precipitates









Widmanstätten and bainite feathers at decreasing T in a Fe-0.3C-0.5Si alloy







Some views on evolution of bainite in time scale





Bhadeshia and Honeycombe 2006





Two steps of bainite formation





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Degenerate and cooperative growth

Degenerate



Fe-0.3C-0.5Si, 550°C, 1s

Cooperative 500nn

Fe-0.3C-0.5Mn-0.5Si, 500°C, 6s Fe-0.3C-0.5Si, 400°C, 2s







Chemical composition of as-recieved alloys

Alloy	C (mass%)	Mn (mass%)	Si (mass%)	Ms (°C, cal.)
Fe-0.7C	0.699	0.003	0.033	266

Isothermal heat treatment LOM, SEM, ECCI, EBSD

ECCI, Electron channeling contrast imaging









550°C, 2s, SEM

500°C, 8s, ECCI







Chevron structure at decreasing T



450°C, 5s

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Chevron structure at decreasing T cont.







Internal morphology at 550°C







Internal morphology at 500°C







Internal morphology at 500°C cont.



Pearlite grows in between bainite regions.



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Internal morphology at 450°C







Crystallographic preference for acicular ferrite

Fe-0.7C, 450°C, 8s, EBSD map







Side layers





Internal morphology at 400°C



Two variants of ferrite

Upper or lower bainite ?



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Internal morphology at 300°C







Feathery bainite at 300°C, EBSD study







Two steps of bainite formation





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Cross sections of lath-shaped ferrite plates



Fe-0.3C-0.5Si, 500°C, 2s, SEM







Early stage of widening



When a ferrite lath widens, it tends to start with protrusion from its two long edges, the change of growth direction accompanies with lattice rotation.





Widening, a more complicate case

EBSD pattern quality map

EBSD misorientation map referring to a point



Stacking of units within a packet.

The difference of colour reveals that the packets have developed through at least two processes.





Widening, a more complicate case cont.



Interior of the grain is free of bainite. The nucleation sites of ferrite plates are in contact with a grain boundary, which is below or above the present section.







Summary

- > Ferrite particles, grain boundary, no sharp change of morphology with temperature.
- > Two stages, second stage with eutectoid reaction, degenerate or cooperative manner.
- > Widening, change of growth direction, lattice rotation.
- Importance of interpretation in 3D.





Thank you for your kind attention!

