Interface-related Phenomena in Displacive Transformations of Steel

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Abstract

Martensite and bainite transformations are categorized as displacive transformations by holding rigid lattice correspondence and crystallographic orientation relationships with respect to austenite matrix are both important in current high strength steels. When a diffusionless transformation mode is imagined, glissile (conservative) motion in migration of martensite/austenite interphase boundary is often assumed. However, in reality, complex strain accommodation taking place due to large transformation strain leads to the introduction of many obstacles against boundary migration, sessile components at interfacial dislocations and matrix dislocations. As a result, a large friction causing energy dissipation occurs in growth of martensite and bainite as well as Widmanstatten ferrite, and extra driving force is required for overcoming elastic strain energy still accumulated due to inefficient plastic accommodation.

In this presentation, current understandings of transformation interfaces in atomic scale for these displacive transformations in steels [1] are revisited to clarify the growth mechanisms and to discuss classical and recent theoretical treatments in transformation pathways. Then, the natures of bainite transformation kinetics as a diffusional-displacive mix-mode transformation [2] will be described including complex alloy partitioning behaviors [3].

References

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