

Material Characterization for Improving Mechanical Properties

The Oakland University and School of Engineering and Computer Science communities are invited to attend Jian Zhu's defense of his Ph.D. dissertation. Seating is limited. RSVP with Katie Loodeen at loodeen@oakland.edu.

Bainite Transformation Kinetics-Morphology Characterization of Austempered 4140/4150 Steel

Committee: Gary Barber, Ph.D. (Chair), Xichen Sun, Ph.D.,
Meir Shillor, Ph.D., David Schall, Ph.D.

Bainite transformation in steel involves understanding of its kinetics, morphology, activation energy, carbon content's effect and dislocation density generated. This research studied the characteristics of all these aspects of the 4140/4150 steel in a wide range of austempering processes, in which four bainite phase matrices were transformed: upper bainite, mixed upper bainite and lower bainite, lower bainite, and mixed lower bainite and martensite. The kinetics of 4140/4150 steel bainite transformation has been described with a linear trend using an Avrami n value. The bainitic ferrite sheaves grow with widthwise preference. The sheaves are stable when half-grown and are variable in length, due to austenite size limit, soft/hard impingement, and autocatalytic nucleation. The full-grown upper/lower bainite sheaves were found to be at 1.9 μm /1.2 μm in width. Each individual bainite sheave is lath-like instead of wedge-like as usually described. The upper bainite sheaves mostly appear as broad-short-coarse lath, and the lower bainite sheaves appear as narrow-long-fine lath. The overall bainite transformation activation energy ranges from 50-167KJ/mol as found from the Arrhenius equation. Carbon content's effect on kinetics and average dislocation density were also estimated.

Time: 10:30 a.m. – 12:30 p.m.
Date: Thursday, Feb. 14, 2019
Location: 347 EC

