

THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT COLLOQUIUM SERIES PRESENTS:

Shrikant Bhat

Senior Principal Scientist, ArcelorMittal Global R & D.



Cyclic Stability and Strain Localization during Fatigue of Advanced High Strength Steels

Cycle dependent changes in deformation resistance have been challenges in both engineering design of structures and new steel grade development for almost 200 years. Newer Advanced High Strength Steel (AHSS) grades with higher Tensile strength and ductility are being developed at an ever increasing pace utilizing a combination of metallurgical strengthening mechanisms. Many of these alloy designs often result in challenges to meet the implementation requirements from “end-use” and “in-use” perspectives, including component durability. This seminar will highlight two related aspects in developing fatigue resistant steel grades. First, cycle dependent changes in deformation resistance of several commercial steel grades will be illustrated with special emphasis on the role of the second phase in a ferrite matrix. The second aspect refers to how a slip line develops into a crack from cyclic deformation over many thousands of cycles. It is well known that strain localization leads to the formation of Persistent Slip Bands (PSBs) which eventually become fatigue cracks. The role of the second phase particles that impart static strengthening, especially martensite/bainite, in strain localization and the evolution of PSBs will be illustrated through quantitative stereological observations. These semi-empirical models indicate that reducing strain localization is beneficial for improved fatigue resistance. Utilization of these concepts in commercial steel grade development will also be highlighted.

Dr. Shrikant P. Bhat is a Senior Principal Scientist at ArcelorMittal Global R&D, East Chicago, IN. He obtained his Ph. D. (1978) in Metallurgy and Materials Science from the University of Pennsylvania, Philadelphia and continued as a Post-Doctoral fellow. He joined the former Inland Steel R&D Center in early 1979 and has enjoyed working in a variety of challenging positions both within Research and Steel Manufacturing. He has held various managerial positions and has worked extensively with customer R&D Centers in advanced engineering phases. His research interests have spanned cyclic deformation and fatigue, hydrogen susceptibility, deformation modelling and many other aspects related to steel usage. He has been an Adjunct Professor at Purdue University Northwest, and a Guest Lecturer at the Stronach Center for Innovation, University of Toronto. He has served on many thesis committees and was a Co-Principal Investigator for the Inland Steel – Northwestern University cooperative research program funded by NSF. He has won several awards, including the Michael C. Tenenbaum Award for the Best Paper, Inland Steel Chairman’s awards, and the Electron Microscopy Society of America Presidential Scholarship.

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