

Seminar

Institute for Plasma Research

- Title:** Microstructural engineering across length scales in structural alloys
- Speaker:** Dr. Nitin Kumar Sharma
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- Date:** 30th September 2022 (Friday)
- Time:** 11:00 AM
- Venue:** Seminar Hall, IPR

Abstract

Structure is one of the most important aspect of materials tetrahedron because the properties and performance of materials depend heavily on their internal structure. Microstructural constituents such as grains, grain boundaries, precipitates, local elemental segregation etc. can be fine-tuned or engineered across length scales to tailor the suitable properties. This talk will try to establish this microstructural engineering through appropriate case studies and the use of different characterization tools. As a case study, microstructural evolution during high frequency electric resistant welding (HF-ERW) will be discussed. HF-ERW is one of the extensively used manufacturing processes for the production of longitudinal seamed steel pipes. The pipes produced by this technique are frequently used in many critical applications, including transportation of oil and gas. The bondline of electric-resistance welded linepipe steel, often etched white in optical microscopy, is generally believed to be carbon-depleted. The mechanism for the carbon-depletion, however, is not fully understood by researchers. To this end, atom probe tomography (APT) was used to measure elemental segregation of the as-welded and post-weld heat-treated bondline regions of X70 linepipe welds. Present work includes a systematic analysis to characterize thin vertical features at the bondline in the as-welded condition. The carbon depletion in the ERW bondline was accurately measured. A new mechanism for carbon-depletion has been proposed using thermodynamic calculations of elemental partitioning during weld formation. Segregation of elements in the heat-affected zone was shown to follow the Negligible partitioning local equilibrium (NPLE) kinetics for austenite to ferrite transformation. Dissolution of Nb(C,N) during post-weld heat treatment (PWHT) resulted in the presence of only Ti-rich nitrides for higher peak temperature sample, hence affecting the on-cooling transformation and room temperature microstructure Dr. Sharma is currently an Assistant Professor in the department of Metallurgical and Materials Engineering at Indian Institute of Technology (IIT) Jodhpur. His research group at IIT Jodhpur is working on different aspects of structural alloys surrounding microstructural transformations, supported by funding from the institute as well as DST-SERB. He is a life time member of Indian Institute of Metals (IIM) and Electron Microscopy Society of India (EMSI). He has given contributory as well as invited lectures related to his research works at various national and international conferences and also won reputed awards such as Student Research Award by The Minerals, Metals & Materials Society (TMS). Dr. Sharma was selected for Shastri Research Student Postdoctoral Fellowship and National Postdoctoral Fellowship. He was also awarded a research grant by Oak Ridge National Laboratory (ORNL) to carry out research experiments during his Post-doc. Dr. Sharma has published more than 20 manuscripts in peer-reviewed journals of international repute, proceedings of international conference, and book chapters out of his research works.
