National Institute of Technology Rourkela

Registration Seminar

Seminar Title	: Thermomechanical controlled processing of low carbon micro-alloyed steels: microstructure and mechanical properties
Speaker	: Sankhadip Mandal (Rollno : 922mm5002)
Supervisor	: Natraj Yedla
Venue	: MM Annex Building-M.Tech class room
Date and Time	: 17 Jul 2025 (10.30 AM)
Abstract	: Low-carbon microalloyed steels are designed with small additions of elements like Nb, V, Ti, and Mo to enhance strength and toughness through precipitation and grain refinement mechanisms. Their microstructure typically consists of ferrite, pearlite, bainite, or martensite, with precipitates such as NbCN, TiCN, VCN, and MoC playing key roles in strengthening. However, technical gaps remain in accurately identifying phases, understanding the stability of complex precipitates, and optimizing thermomechanical treatment parameters to control phase transformation and precipitation during industrial plate rolling operation. This study focuses on CMnNb, CMnNbV, CMnNbCr, and CMnNbMo steels to evaluate how specific microalloying combinations affect precipitation kinetics and transformation behaviour under TMCP (Thermo-mechanical Control processing) conditions. Recrystallization behaviour was evaluated using a physically based empirical model that incorporates both dynamic and static recrystallization kinetics. The model considers the influence of alloying elements, deformation temperature, strain, strain rate, and inter-pass time on the initiation and progression of recrystallization, as well as the start and completion of precipitation and the accumulation of strain. Predictions of austenite grain size and the extent of recrystallization were employed to interpret the hot deformation response and guide microstructural control. This comprehensive framework provides a scientific foundation for optimizing TMCP parameters to enhance the strength and toughness of high strength microalloyed steels