**Analysis of Microstructure – Properties Relationship in Steels**

**RECENT RESEARCH ACTIVITIES:**

**Facing Challenges in the Development of 3D micromechanical models for Q&P steels.**

*Quenching & Partitioning* (Q&P) is one of the most interesting metallurgical concepts to develop new Advanced High Strength Steels (AHSSs). Their promising properties stem from a complex multi-phase microstructure. In order to enable the smart design of microstructures leading to improved mechanical properties, it is crucial to understand how specific microstructural features influence the underlying mechanisms during the Q&P route. With the sufficient knowledge, microstructural features as the morphology, size and distribution of the phases as well as their internal properties can be tuned to adjust a certain property or a group of them. For instance, it has been found that the refinement of the Prior Austenite Grain Size (PAGS) results in: (1) formation of different phase fractions under fixed Q&P conditions; (2) a martensite block size reduction, whereas the retain austenite block size remains essentially constant and (3) different carbon redistribution. The predictive capacity of *3D micromechanical models* has significantly improved over the last years; however, the complexity of the Q&P microstructures makes it very difficult to experimentally measure the properties of individual phases constituting the microstructure. This makes the quality of the models insufficient to be applied to Q&P steels and other multi-phase steels. Some challenges to be addressed are: (1) the influence of processing parameters on individual phase properties such as dislocation density, composition and size (2) the effect of phase properties on the mechanical properties of individual phases; (3) the effect of phases mutual interaction to the strengthening contribution in the steel.

**KEY PUBLICATIONS:**

