World Academy of Science, Engineering and Technology
International Journal of Structural and Construction Engineering
Vol:13, No:04, 2019

# Effect of Segregation Pattern of Mn, Si, and C on through Thickness Microstructure and Properties of Hot Rolled Steel

**Authors :** Waleed M. Al-Othman, Hamid Bayati, Abdullah Al-Shahrani, Haitham Al-Jabr

**Abstract :** Pearlite bands commonly form parallel to the surface of the hot rolled steel and have significant influence on the properties of the steel. This study investigated the correlation between segregation pattern of Mn, Si, C and formation of the pearlite bands in hot rolled Gr 60 steel plate. Microstructural study indicated formation of a distinguished thick band at centerline of the plate with number of parallel bands through thickness of the steel plate. The thickness, frequency, and continuity of the bands are reduced from mid-thickness toward external surface of the steel plate. Analysis showed a noticeable increase of C, Si and Mn levels within the bands. Such alloying segregation takes place during metal solidification. EDS analysis verified presence of particles rich in Ti, Nb, Mn, C, N, within the bands. Texture analysis by Electron Backscatter Detector (EBSD) indicated the grains size/misorientation can noticeably change within the bands. Effect of banding on through-thickness properties of the steel was examined by carrying out microhardness, toughness and tensile tests. Results suggest the Mn and C contents are changed in sinusoidal pattern through thickness of the hot rolled plate and pearlite bands are formed at the peaks of this sinusoidal segregation pattern. Changes in grain size/misorientation, formation of highly alloyed particles, and pearlite within these bands, facilitate crack formation along boundaries of these bands.

**Keywords :** pearlite band, alloying segregation, hot rolling, Ti,Nb, N, C
**Conference Title :** ICSSCI 2019 : International Conference on Steel Structures and Construction Industry
**Conference Location :** Venice, Italy
**Conference Dates :** April 11-12, 2019

Open Science Index, Structural and Construction Engineering Vol:13, No:04, 2019 publications.waset.org/abstracts/100222.pdf