

Title: Nano-hardness Analysis of Dendritic and Inter-Dendritic Regions in As-Cast Steel

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A nano-indentation hardness study has been conducted on dendritic and inter-dendritic regions in as-cast medium-carbon steel. The mechanical properties of both segregated (inter-dendritic) and non-segregated (dendritic) regions were determined at room temperature by using a UMIS-2000 nano-indenter, which continuously measures force and displacement as an indentation is made. The indenter in this particular instrument is a Berkovich diamond three-sided pyramid (Ei=1140 GPa, vi= 0.07) with a nominal angle of 65.3° and an area-to-depth function which is the same as that of a Vickers indenter. As-cast specimens were etched in picric acid to reveal the dendritic structure prior to performing nano-indentation, optical microscopy and Atomic-force microscopy (AFM). A matrix of 120 indentations was made on etched samples with a maximum load of 30 mN, the indentations being separated by 10 μm and an average value for each region was determined. From the data obtained during unloading of the indentation, elastic displacements were determined and from these measurements the elastic modulus was calculated. Furthermore, by removing the elastic contribution from the total displacement, the hardness was calculated for each region. Nano-hardness results revealed that at nano-scale hardness is lower for dendritic regions when compared to inter-dendritic regions. There was a slight reduction in hardness in the dendritic regions that presents ferritic matrix while the inter-dendritic regions showed higher hardness at nano-scale.

Biography

Dr. Al-Gahtani has completed his PhD from University of Wollongong, Australia in 2015. He is a lead scientist at SABIC Technology Center, Saudi Arabia. He has published several papers in steel making and casting area.

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