Title

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Abstract

Microhardness test has been used as an alternative test for measuring material's tensile properties. The test is especially useful when there are significant property gradient within a small dimension, or only a limited quantity of material is available, or the material is located at an inconvenient location. Attempts have often been made to establish the correlation between microhardness values and tensile properties, either yield strength or tensile strength. However, conflicting results have been found regarding the existence of such relations for steels partially due to the large scatters of the microhardness test data. One contributing factor could be the large variance of the test conditions. For example, the indentation load varies from 0.1 kilo-gram-force (kgf) to 1.0 kgf and the number of repeated tests range from a few to as many as 40. Previous work by a number of researchers found the measured microhardness depends on the indentation load. For polycrystalline materials, the indentation load must be large enough to induce plastic strains in several grains before the measured hardness stabilized. Most structural steels have multiple phases, for example, soft ferrite, hard bainite or pearlite etc. The effect of the multiple phases on producing a load-independent microhardness value is not well understood. In this paper, three-dimensional (3D) finite element analyses (FEA) are conducted to simulate the microindentation process of a two-phase linepine steel. The effect of the size of the 2nd phase and the indentation touch-down location on the hardness is analyzed. The work is aimed at understanding the variation of microhardness values and establishing guidelines for obtaining consistent hardness measurement.

Keywords

Microhardness, Vickers hardness