Image Processing of Scanning Electron Microscope Micrograph of Ferrite and Pearlite Steel for Recognition of Micro-Constituents

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Abstract : In this paper, we demonstrate the new area of application of image processing in metallurgical images to develop the more opportunity for structure-property correlation based approaches of alloy design. The present exercise focuses on the development of image processing tools suitable for phrase segmentation, grain boundary detection and recognition of micro-constituents in SEM micrographs of ferrite and pearlite steels. A comprehensive data of micrographs have been experimentally developed encompassing the variation of ferrite and pearlite volume fractions and taking images at different magnification (500X, 1000X, 15000X, 2000X, 3000X and 5000X) under scanning electron microscope. The variation in the volume fraction has been achieved using four different plain carbon steel containing 0.1, 0.22, 0.35 and 0.48 wt% C heat treated under annealing and normalizing treatments. The obtained data pool of micrographs arbitrarily divided into two parts to developing training and testing sets of micrographs. The statistical recognition features for ferrite and pearlite constituents have been developed by learning from training set of micrographs. The obtained features for microstructure pattern recognition are applied to test set of micrographs. The analysis of the result shows that the developed strategy can successfully detect the micro constitutes across the wide range of magnification and variation of volume fractions of the constituents in the structure with an accuracy of about +/- 5%.

Keywords : SEM micrograph, metallurgical image processing, ferrite pearlite steel, microstructure

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