ABSTRACT

Bucket tooth excavator is a part that first comes into contact with the work material during the earthworks process, which receives friction and impact forces and can experience wear and tear along with the intensity of its contact with the work material. Manganese steel is generally used as bucket teeth excavator material because of its wear and impact resistant properties. The elements that greatly influence the mechanical properties of manganese steel are the composition of manganese (Mn) and carbon (C). PT Baja Kurnia is a manufacturer of bucket teeth excavator made from manganese steel. Variations in the composition of manganese steel produced range from 11-19% wt Mn. Steel with variations in manganese composition needs to be researched to obtain material recommendations with the most optimal wear and impact resistant mechanical properties for excavator bucket teeth.

The research was carried out by varying the addition of the manganese element 11-19% Mn by weight to the molten steel by inoculation. The research object is a sample of raw material manganese steel with a variation in the manganese element composition of 12.36%; 14.02%; 14.67%; 16.85%; 17.37%. Each research object was formed into two impact specimens with dimensions (55 x 10 x 7.5) mm and one universal specimen with dimensions (20 x 10 x 10) mm. Tests carried out include Vickers hardness test, Ogoshi wear test, Charpy impact test and microstructural analysis (micrographic observation).

Test results show an increase in wear resistance of up to 42.7% as the manganese composition increases from 12.36% wt Mn to 16.85% wt Mn. Hardness increases by up to 12% as the manganese composition increases from 12.36% wt Mn to 16.85% wt Mn. Impact resistance increased by 32.8% as the manganese content increased from 14.02% wt Mn to 16.85% wt Mn. The increase in wear resistance and hardness on manganese steel are caused by reduction in austenite grain size and the carbides formations (Mn_3C, $(FeMn)_3C$ and $(FeMnCr)_{23}C_6$). Hence, manganese steel with 16.85%wt Mn content is the optimal material and highly recommended to be excavator bucket teeth material.

Keywords: Hadfield Steel, manganese steel, bucket teeth excavator, physical properties, mechanical properties

INTISARI

Bucket teeth excavator merupakan bagian yang pertama kali bersinggungan dengan material kerja saat proses pengerjaan tanah, yang menerima gaya gesek dan impak serta dapat mengalami aus dan patah seiring dengan intensitasnya dalam bersinggungan dengan material kerja. *Manganese steel* umumnya digunakan sebagai material *bucket teeth excavator* karena sifat tahan aus dan bentur. Unsur yang sangat mempengaruhi sifat mekanik *manganese steel* adalah komposisi mangan (Mn) dan karbon (C). PT Baja Kurnia merupakan produsen *bucket teeth excavator* berbahan *manganese steel*. Variasi komposisi *manganese steel* yang diproduksi berkisar 11-19% berat mangan. Baja dengan variasi komposisi mangan tersebut perlu diteliti untuk mendapatkan rekomendasi material dengan sifat mekanik tahan aus dan impak paling optimal untuk *bucket teeth excavator*.

Penelitian dilakukan dengan memvariasikan penambahan unsur mangan 11-19% berat Mn pada baja secara inokulasi. Objek penelitian berupa sampel raw material *manganese steel* dengan variasi komposisi unsur mangan 12,36%; 14,02%; 14,67%; 16,85%; 17,37%. Masing-masing objek penelitian dibentuk menjadi dua spesimen impak dengan dimensi (55 x 10 x 7,5) mm dan satu spesimen universal berdimensi (20 x 10 x 10) mm. Pengujian yang dilakukan meliputi uji kekerasan *Vickers*, uji keausan *Ogoshi*, uji impak *Charpy* dan analisis struktur mikro (*micrographic observation*).

Hasil pengujian memperlihatkan adanya peningkatan ketahanan aus hingga 42,7% seiring peningkatan komposisi mangan dari 12,36% berat Mn menjadi 16,85% berat Mn. Kekerasan meningkat hingga 12% seiring peningkatan komposisi mangan dari 12,36% berat Mn menjadi 16,85% berat Mn. Ketahanan impak meningkat sebesar 32,8% seiring peningkatan kadar mangan dari 14,02% berat Mn menjadi 16,85% berat Mn. Peningkatan ketahanan aus dan kekerasan disebabkan oleh pengurangan ukuran butir austenit serta pembentukan karbida Mn_3C, $(FeMn)_3C$ dan $(FeMnCr)_{23}C_6$ pada baja. Oleh karena itu, baja mangan dengan kandungan 16,85% berat Mn menjadi material yang optimal dan dapat direkomendasi untuk pembuatan *bucket teeth excavator*.

Kata kunci: komposisi baja mangan, komponen ekskavator, sifat fisik material, sifat mekanik material