ABSTRACT

The heavy duty excavator uses bucket in moving materials that contain various phase with different weight, solidity, and hardness, so that impact forces and wear may be applied when the bucket loads materials. In this condition, manufactures aim to design the bucket, specifically the tooth, with high impact capacity and wear resistance to increase its lifetime. However, increasing the component's hardness is the easiest way to achieve a higher wear resistance, in which impact capacity is directly decreased. This study, based on the materials failure analysis subject, aims to define the most proper composition of manganese in the material of bucket's tooth after quench-tempered.

Studying the mixture of materials, and its effect from each atomic molecule, were very helpful to design the most proper materials. Books and journals related to this subject, had been studied to conduct the proper way of each process and predicting the material's properties. This study consisted of mechanical testing, and microstructures analysis to compare the properties of each specimen. Specimens, was determined to be 5 types of Hadfield manganese steel, named by its inventor, that contain 11%, 12%, 13%, 14%, and 15% of manganese and had been heat-treated with quenching and tempering.

Manganese, as the major alloy of Hadfield steel, shows the most dominant effect to material's properties. The manganese capability in forming austenite phase is very useful to increase the impact capacity. As the material mostly consists of austenite phase, the increase of hardness and wear-resistance should not trigger the material's brittleness. The mechanical testing of the quench-tempered material showed that the highest composition of manganese, which is 15% Mn, has the highest hardness number of 223,17 VHN, and impact energy of 0,24 J/mm^2.

Keywords : manganese, quenching, tempering

ABSTRAK

Excavator merupakan alat berat yang digunakan untuk melakukan pemindahan material, pengerukan, serta penggalian pada berbagai jenis material sehingga mengalami beban impak, tekan, serta gesek pada bagian *bucket tooth*-nya. Beban kerja komponen yang berat membuat industri alat berat perlu membuat komponen *bucket tooth* yang memiliki ketahanan impak dan ketahanan aus yang tinggi. Peningkatan kekerasan, merupakan salah satu cara untuk meningkatkan ketahanan aus material yang biasanya diikuti dengan penurunan ketahanan impak. Penelitian pada material *bucket tooth* dilakukan untuk mengetahui komposisi material yang paling baik digunakan pada *bucket tooth* setelah dilakukan perlakuan panas *quenching-tempering.*

Penelitian pada material *bucket tooth* diawali dengan mempelajari sifat-sifat material beserta pengaruh unsur paduannya. Pengujian kekerasan, ketahanan aus, ketahanan impak, serta analisa struktur mikro dilakukan pada material baja mangan dengan komposisi mangan 11-15% Mn yang sudah mengalami perlakuan panas berupa *quenching-tempering.* Hasil pengujian yang didapatkan kemudian dianalisis untuk melihat pengaruh komposisi mangan setelah material diberi perlakuan panas *quenching-tempering.*

Komposisi mangan pada baja mangan berpengaruh pada sifat mekanik material setelah diberi perlakuan panas. Struktur mikro baja mangan berupa *austenite* membuat material memiliki ketahanan impak yang baik meskipun di-*quenching.* Hasil pengujian material menunjukkan baja mangan dengan kadar mangan 15% Mn yang diberi perlakuan *quenching-tempering* memiliki ketahanan impak dan nilai kekerasan paling tinggi, yaitu 0,24 J/mm^2 dan 223,17 VHN.