Pengaruh Penambahan Surfaktan Polyethylene Glycol Terhadap Konduktivitas Termal Nanofluida Berbasis Graphene Oxide dan Sebagai Media Quench Baja S45C = Effect of Addition of Polyethylene Glycol Surfactant on Thermal Conductivity of Graphene Oxide-Based Nanofluids and as Quench Media for S45C Steel

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Abstrak

Kekerasan suatu material dapat ditingkatkan dengan merubah fasa mikrostrukturnya melalui perlakuan panas quenching. Graphene oxide memiliki nilai konduktivitas termal yang tinggi dan bersifat hidrofilik dikarakterisasikan dengan uji Electron Dispersive Spectroscopy (EDS) dan Scanning Electron Microscopy (SEM), lalu disintesis menjadi nanofluida dengan fluida dasar air distilasi dan penambahan surfaktan polyethylene glycol (PEG). Variasi sintesis nanofluida menjadi GO 0.01%, 0.03% dan 0.05% dengan PEG 0%, 3%, 5%, dan 7%. Nanofluida berbasis GO dikarakterisasi zeta potensial dan konduktivitas termalnya, sebelum dikarakterisasi, nanofluida diberikan perlakuan ultrasonik. Baja S45C merupakan baja karbon medium, dalam quenching baja karbon medium diperlukan media quench dengan cooling rate yang tinggi untuk mencapai martensite. Baja hasil quenching diuji nilai kekerasannya dengan metode Rockwell dan diuji metalografi untuk diamati mikrostrukturnya. Hasil data yang didapat menunjukkan penambahan nanopartikel GO dengan jumlah sedikit tidak memberikan pengaruh yang signifikan terhadap nilai konduktivitas termal dan penambahan PEG harus disesuaikan dengan konsentrasi nanopartikelnya untuk mendapat nilai optimum. Nilai konduktivitas termal saja tidak dapat menjadi faktor penentu nilai kekerasan baja hasil quenching.

..... The hardness of a material can be increased by changing its microstructural phase through quenching heat treatment. Graphene oxide has a high thermal conductivity value and is hydrophilic characterized by Electron Dispersive Spectroscopy (EDS) and Scanning Electron Microscopy (SEM) tests, then synthesized into nanofluids with distilled water base fluid and the addition of polyethylene glycol (PEG) surfactant. Variations in the synthesis of nanofluids became GO 0.01%, 0.03% and 0.05% with PEG 0%, 3%, 5%, and 7%. GO-based nanofluids were characterized by their zeta potential and thermal conductivity, before being characterized, the nanofluids were subjected to ultrasonic treatment. S45C steel is a medium carbon steel, medium carbon steel quenching requires a quench medium with a high cooling rate to achieve martensite. The quenched steel was tested for its hardness value by the Rockwell method and metallographically tested to observe its microstructure. The results of the data obtained show that the addition of GO nanoparticles in small amounts does not have a significant effect on the thermal conductivity value and the addition of PEG must be adjusted to the nanoparticle concentration to get the optimum value. The value of thermal conductivity alone cannot be a determining factor for the hardness value of quenched steel.