

Studi pengaruh penggunaan surfaktan CTAB (Cetyl Trimethylammonium Bromide) terhadap konduktivitas termal nanofluida berbasis carbon nanotubes sebagai media quench pada proses perlakuan panas baja S45C = Study of the effect of the use of CTAB (Cetyl Trimethylammonium Bromide) surfactant towards thermal conductivity of carbon nanotubes based nanofluids as a quench media in the heat treatment process of S45C steel

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Abstrak

Kekerasan yang tinggi pada sebuah material dapat dicapai dengan melakukan proses perlakuan panas menggunakan media quench yang memiliki nilai konduktivitas termal yang tinggi, seperti nanofluida. Pada penelitian ini, nanofluida berbasis CNT disintesis menggunakan metode 2 tahap, yaitu dengan mendispersikan CNT dengan konsentrasi sebesar 0,1%, 0,3%, dan 0,5% ke dalam fluida dasar berupa air distilasi yang kemudian ditambahkan surfaktan Cetyl Trimethylammonium Bromide (CTAB) sebanyak 0%, 3%, 5%, dan 7% untuk meningkatkan stabilitasnya, lalu dilakukan ultrasonikasi. Nanofluida tersebut kemudian digunakan sebagai media quench pada sampel baja S45C. Proses perlakuan panas dilakukan dengan memanaskan baja hingga suhu 900°C kemudian di quenching. Baja hasil quenching diamati mikrostrukturnya dan dihitung nilai kekerasannya. Konduktivitas termal nanofluida mengalami penurunan saat digunakan surfaktan CTAB 3%, lalu mengalami peningkatan saat digunakan surfaktan CTAB 5%, dan menurun kembali saat digunakan surfaktan CTAB 7% dengan nilai konduktivitas termal tertinggi diperoleh oleh sampel nanofluida pada konsentrasi CNT 0,3% dengan surfaktan CTAB 5%, yaitu sebesar 0,72 W/mK. Sementara nilai kekerasan tertinggi untuk baja yang di quenching dengan nanofluida adalah sebesar 39 HRC, yaitu ketika digunakan konsentrasi 0,1% CNT tanpa penambahan surfaktan.

.....High hardness of a material can be achieved by doing heat treatment using a quench medium that has a high thermal conductivity value, such as nanofluids. In this study, CNT-based nanofluids were synthesized using a 2-step method, which by dispersing CNT with concentrations of 0.1%, 0.3%, and 0.5% into the base fluid in the form of distilled water which was then added with surfactant Cetyl Trimethylammonium Bromide (CTAB) as much as 0%, 3%, 5%, and 7% to increase their stability, then ultrasonication was performed. The nanofluid was then used as a quench medium for the S45C steel sample. The heat treatment process is carried out by heating the steel to a temperature of 900°C then quench it. The quenched steel was observed for its microstructure and the hardness was calculated. The thermal conductivity of nanofluids decreased when 3% CTAB surfactant was used, increased when 5% CTAB surfactant was used, and decreased when 7% CTAB surfactant was used with the highest thermal conductivity value obtained by nanofluid samples at 0.3% CNT concentration with 5% CTAB surfactant, which the value is 0.72 W/mK. Meanwhile, the highest hardness value for steel quenched with nanofluids was 39 HRC, when 0.1% CNT was used without the addition of surfactants.