Pengaruh penambahan sodium dodecyl benzene sulphonate sebagai surfaktan terhadap konduktivitas termal nanofluida berbasis carbon nanotubes sebagai media quench pada proses perlakuan panas baja S45C = The effect of sodium dodecyl benzene sulphonate addition as surfactant on the thermal conductivity of carbon nanotubes-based nanofluid as quenchant in the heat treatment process of S45C Steel

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Abstrak

Quenchant dengan konduktivitas termal tinggi dapat meningkatkan laju pendinginan, sehingga didapat hasil perlakuan panas dengan sifat mekanis yang lebih baik. Salah satu cara meningkatkan konduktivitas termal adalah dengan membuat nanofluida. Pada penelitian ini, digunakan nanopartikel berupa Multi-walled Carbon Nanotubes (MWCNT) as-received. Nanofluida berbasis CNT disintesis menggunakan metode dua tahap. CNT dengan konsentrasi sebesar 0,1%, 0,3%, dan 0,5% didispersikan pada fluida dasar berupa air distilasi. Untuk meningkatkan stabilitas nanofluida, ditambahkan surfaktan Sodium Dodecyl Benzene Sulphonate (SDBS) sebanyak 3%, 5%, dan 7% serta dilakukan ultrasonikasi selama 15 menit. Nanofluida tersebut digunakan sebagai quenchant dengan lama imersi 4 menit untuk proses perlakuan panas baja S45C dengan temperatur austenisasi sebesar 900C. Hasil penelitian menunjukkan bahwa konduktivitas termal nanofluida meningkat seiring dengan penambahan konsentrasi CNT, kecuali pada sampel tanpa penambahan surfaktan. Seiring penambahan surfaktan, konduktivitas termal meningkat hingga mencapai kadar optimum dan kemudian menurun, kecuali pada sampel dengan penambahan surfaktan sebanyak 3%. Nilai kekerasan baja S45C hasil quenching tidak dipengaruhi secara linear oleh konduktivitas termal quenchant.
.....Quenchant with high thermal conductivity could increase the cooling rate; hence heat treatment results with better mechanical properties are obtained. One method to increase the thermal conductivity is by creating nanofluids. In this study, Multi-walled Carbon Nanotubes (MWCNT) as-received were used as nanoparticles. The CNT-based nanofluids were synthesized using the two-step method. CNTs with concentrations of 0.1%, 0.3%, and 0.5% were dispersed to the base fluid, distilled water. To increase the stability of the nanofluids, Sodium Dodecyl Benzene Sulphonate (SDBS) surfactants as much as 3%, 5%, and 7% were added; further, ultrasonication was carried out for 15 minutes. The nanofluids were used as quenchants with an immersion time of 4 minutes for the heat treatment process of S45C steel with an austenitizing temperature of 900C. The results showed that the thermal conductivity of nanofluids increased with the addition of CNT concentration, except for samples without the addition of surfactants. On the other side, as more surfactants were added, the thermal conductivity increased until it reached the optimum level and then

decreased, except for samples with 3% surfactant. The hardness values of quenched S45C steels are not linearly affected by the thermal conductivity of the quenchants.