Water-Polyethylene Glycol/ (Sic-Wc) And (Ceo2-Wc)Nanofluids For Saving Solar Energy

Abbas Sahi Shareef, Farhan Lafta Rashid, Aseel Hadi and Ahmed Hashim

Abstract: The enhancement of thermal performance for water - polyethylene glycol with (SiC-WC) and (CeO2-WC) for saveandrelease of solar thermal energy have investigated for highgain of melting and solidification times. The experimental resultsshowed thatthe time of heating and cooling decrease with the increase of (SiC-WC) and (CeO2-WC) concentrations. The times of heating and cooling decrease with an increase in WC nanoparticles concentrations to water-PEG/CeO_2 and water-PEG/SiC nanosystems.

Keywords: phase change, WC, solar energy, CeO2, energy storage.

1. INTRODUCTION

Due to increasing demand of energy, the renewable energy sources are particularly attractive. But the energy storage in a suitable forms is as important as developing renewable energy sources. One of the difficulties for using thermal solar energy as a sustainable energy is how to save it through nights or when don't access. The system of latent heat for save the thermal energy uses (PCMs): phase change materials which be an effective method of storage the energy. Related to the high storage density and isothermal phase transition, PCMs used in the system of latent heat thermal energy storage such as solar energy and applications of spacecraft thermal control [1,2].Nanofluids can be obtained by dispersing different nanoparticles in public fluids (such as water) for enhancing thermal properties. Nanofluids are capable to upgrade the stability, thermal conductivity, coefficient of heat transfer, and decrease the costs power consumed. All these benefits made arising capability in the use of nanofluids in different kinds of heat transfer exchangers; accordingly, revealing appropriate nanofluids with amended properties of heat transfer and high thermal conductivity. Great efforts have been done to enhance the performance of systems such as heat transfer process.

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at one side and the system minimizing at the other side. If nanofluidis used as an alternative heat transfer fluid, they offer great abilities to have those challenges. Nanofluids can be produced by dispersing 1-100 nm sized metallic or nonmetallic particles into conventional base fluids (for example water, oil, ethylene glycol, etc.). This modern heat transfer fluid beats the problems found in the use of the fluid including larger suspended particles (particles in mm or µm sized), such as rapid sedimentation, clogging, abrasion, and fouling [3,4].

MATERIALS AND METHODS

Nanofluids of water /polyethylene glycol(PEG) with cerium oxide(CeO_2)-tungsten carbide (WC)and (SiC) silicon carbide-tungsten carbide (WC)nanoparticles were prepared with ratios of nanoparticles are water -polyethylene glycol(0.02 gm)/ $(CeO_2)_{0.05-x}$-WC_x nanoparticles andwater-polyethylene glycol/ $(SiC)_{0.05-x}$-WC_x nanoparticles, where x=0.005, 0.01 and 0.015) where WC nanoparticles were added to each one of SiC and $CeO_2$with concentrations are (10, 20, and 30) wt.%. The (SiC-WC) and (CeO2-WC)nanoparticleswere added to water with concentration (1.67×10^{-3} g/mL). The water /polyethylene glycol with (SiC-WC) and (CeO2-WC) nanoparticles nanofluids are used for heat transfer nanofluids, where the temperature rise from 30ºC to temperature 100°C with continuous stirring. The temperature measuresduring the cooling and heatingprocesses usingdigital instrument.

RESULTS AND DISCUSSION

Figures(1-4) indicate to curves of melting and solidification for water /PEG with (SiC-WC) and (CeO2-WC)nanoparticles. The times of heating and cooling decrease as (SiC-WC) and (CeO2-WC)nanoparticles concentrations increase. The faster rates of heating and cooling processes of nanocomposites will enhances thethermal conductivity of a paths network inside thenanofluids,and thus enhances the thermal conductivity [5-13].

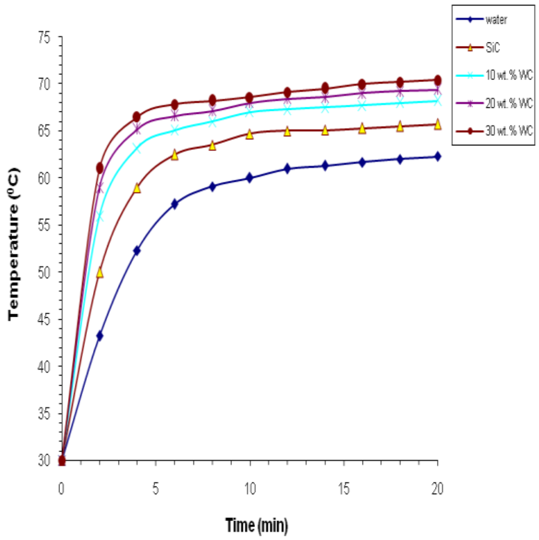

Figure 1. *Heating curves of water /PEG-(SiC -WC).*

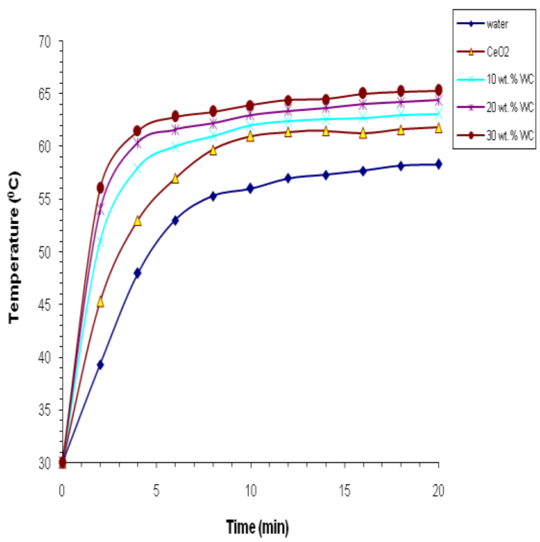

Figure 2. *Heating curves of water /PEG -(CeO_2-WC).*

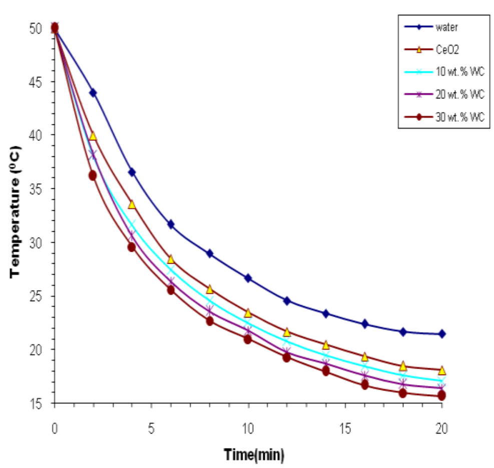

Figure 3. *Cooling curves of water /PEG-(CeO_2-WC).*

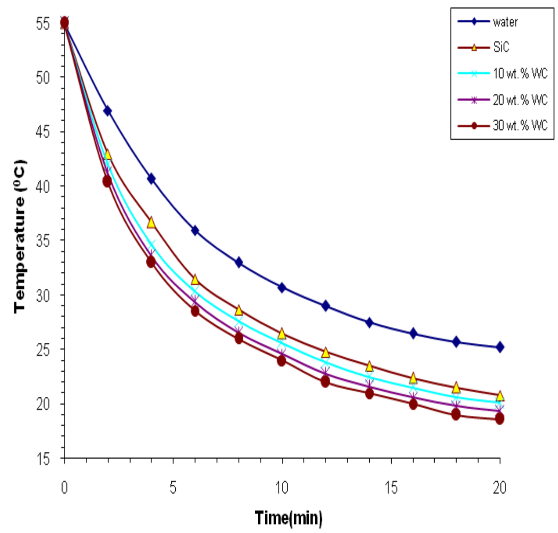

Figure 4. *Cooling curves of water /PEG -(SiC-WC).*

CONCLUSIONS

1. The water /PEG with (SiC-WC) and (CeO2-WC)nanoparticlesnanofluids have high gain for thermal storage which is used in a heating/cooling systems. The water /PEG with (SiC-WC) and (CeO2-WC)nanoparticlesnanofluids can be take into consideration as energy storage material to save relief domestic environment.
2. The times ofheating andcooling for storage and release of thermal energy are decreasedwithincrease of (SiC-WC) and (CeO2-WC) nanoparticles concentrations.

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