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## Experimental Investigation on the stability of 40% ethylene glycol based TiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> hybrid nanofluids (Article) [\(Open Access\)](#)

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### Abstract

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This paper is presented to investigate experimentally on the stability of 40% ethylene glycol-based TiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> hybrid nanofluids. Recently, the research is more highlighted on the thermophysical-properties of nanofluids. Hence, the stability of the hybrid nanofluids thoroughly assessed in this research work. The study uses the two-step method for preparing 40% ethylene glycol-based TiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> hybrid nanofluids. The experiment is carried out for the various combination of mixture ratios including 20:80, 40:60, 50:50, 60:40 and 80:20 of TiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> nanoparticles with a volume concentration of 0.1%. The stability assessment of hybrid nanofluids is accomplished through visualisation effect, transmission electronic microscopic observation, UV-Vis spectrophotometry and zeta potential value from particle size analyser. The findings show the optimum mixing ratios of TiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> nanoparticles in terms of stability which is further confirmed by Zeta potential and absorbency from UV-Vis spectrophotometry. The results from the study reveal that 80:20 ratio of TiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> nanoparticles possesses the best uniformity for over 21 days without any noticeable settlement of particles in the colloidal suspension. Moreover, 50:50 and 60:40 ratios show modest stability for almost two weeks while 20:80 and 40:60 ratios of TiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> nanoparticles show minimum stability along with rapid sedimentation in the dispersion. However, it is also evident that the optimum mixing ratio of TiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> hybrid nanofluids has excellent stability which will lead to further study on the thermal properties of nanofluids and finally motivate engineers to the real-life application of nanofluids. © 2020 PENERBIT AKADEMIA BARU-All rights reserved.

### SciVal Topic Prominence ⓘ

Topic: Nanofluids | Heat Transfer Enhancement | Automobile Radiators

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- ☐ 1

Asadi, A., Asadi, M., Rezaniakolaei, A., Rosendahl, L.A., Afrand, M., Wongwises, S.

Heat transfer efficiency of Al<sub>2</sub>O<sub>3</sub>-MWCNT/thermal oil hybrid nanofluid as a cooling fluid in thermal and energy management applications: An experimental and theoretical investigation

(2018) *International Journal of Heat and Mass Transfer*, 117, pp. 474-486. Cited 118 times.  
<http://www.journals.elsevier.com.ezproxy.um.edu.my/international-journal-of-heat-and-mass-transfer/>  
doi: 10.1016/j.ijheatmasstransfer.2017.10.036

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- ☐ 2

Kareem, R.S., Abdulhadi, A.M.

Effect of MHD and porous media on nanofluid flow with heat transfer: Numerical treatment

(2019) *Journal of Advanced Research in Fluid Mechanics and Thermal Sciences*, 63 (2), pp. 317-328. Cited 3 times.  
<http://www.akademiabaru.com/arfmts.html>
- ☐ 3

Ouikhalfan, M., Labihi, A., Belaqziz, M., Chehouani, H., Benhamou, B., Sari, A., Belfkira, A.

Stability and thermal conductivity enhancement of aqueous nanofluid based on surfactant-modified TiO<sub>2</sub>

(2020) *Journal of Dispersion Science and Technology*, 41 (3), pp. 374-382. Cited 5 times.  
[www.tandf.co.uk/journals/titles/01932691.asp](http://www.tandf.co.uk/journals/titles/01932691.asp)  
doi: 10.1080/01932691.2019.1578665

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- ☐ 4

Choi, S.U.S., Eastman, J.A.

(1995) *Enhancing thermal conductivity of fluids with nanoparticles*  
No. ANL/MSD/CP-84938; CONF-951135-29. Argonne National Lab., IL (United States)
- ☐ 5

Prasad, K.V., Vaidya, H., Manjunatha, G., Vajravelu, K., Rajashekhar, C., Ramanjini, V.

Influence of Variable Transport Properties on Casson Nanofluid Flow over a Slender Riga Plate: Keller Box Scheme

(2019) *Journal of Advanced Research in Fluid Mechanics and Thermal Sciences*, 64 (1), pp. 19-42.  
<http://www.akademiabaru.com/arfmts.html>
- ☐ 6

Mugilan, T., Sidik, N.A.C., Japar, W.M.A.A.

The use of smart material of nanofluid for heat transfer enhancement in microtube with helically spiral rib and groove

(2017) *Revolution*, 2, p. 2. Cited 3 times.