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# An Extensive Study of Nano Fluids and their Applications in Real Life

**Beena Nawghare[1], Kamalkishor Maniyar[1]*, Aarti Jathar[1], Chaitalee Mali[1], Dhananjay Pawar[2], Sachin P. Jadhav[1], Swapnil Deshmukh[1], Shobha Rupanar[3], Ramdas Biradar[4] Jagannath Gawande[5] and Satypal Warghat[6]**

*[1]Dr. D. Y. Patil Institute of Technology, Pimpri, Pune - 411018, Maharashtra, India; *kkmaniyar2020@gmail.com*
*[2]Vishwakarma Institute of Technology, Pune affiliated to SPPU, Pune - 411037, Maharashtra, India*
*[3]Ajeenkya D. Y. Patil University, School of Engineering, Lohegaon, Pune - 412105, Maharashtra, India*
*[4]School of Engineering and Technology, PCET's Pimpri Chinchwad University, Pune - 412106, Maharashtra, India*
*[5]SPPU, Pune - 411007, Maharashtra, India*
*[6]Takshashila Institute of Engineering and Technology, Darapur - 444814, Amravati, Maharashtra, India*

## Abstract

*As a material with numerous applications, such as heat transmission and detergency, nanofluids are significant. Colloids are nanofluids that have long been used in the biomedical industry; going forward, this use will only grow. Nanofluids have also been demonstrated to be effective as smart fluids. The problems of settling, erosion potential, and aggregation of nanoparticles in the applications need to be carefully studied. For experimental study, nanofluids must have detailed descriptions of their shape, size distribution, particle size, and clustering in order to optimize the results generalizability.*

**Keywords:** *Applications, Characteristics, Development, Nano Fluid*

## 1.0 Introduction

It is evident from current research that nanofluids have better thermal conductivity, and that this effect increases with an increase in the volumetric percentage of nanoparticles[1,2]. Although colloids are not very new as fluids, they are still considered nanofluids and have been studied for a long time[3,4]. An analysis of experimental studies revealed that the stated conclusions of multiple research groups regarding thermal characteristics were inconsistent[5,6]. Particle size and shape, fluid temperature, dissociation of surfactants, and particle clustering are a few of the significant variables related to the effective thermal conductivity of nanofluids that have not received enough attention[7-9]. It will need more investigation to find out how these factors affect the thermal conductivity of different nanofluids[10,11]. The observed improvement of nanofluids thermal conductivity cannot be explained by classical models[12,13]. Only one or two hypothesized heat transmission routes using nanofluids are included in the majority of recently created models[14,15]. One area that has not received much attention is the computation of the heat transfer coefficients and effective thermal diffusivity of nanofluids in natural convection[16,17].

*Author for correspondence

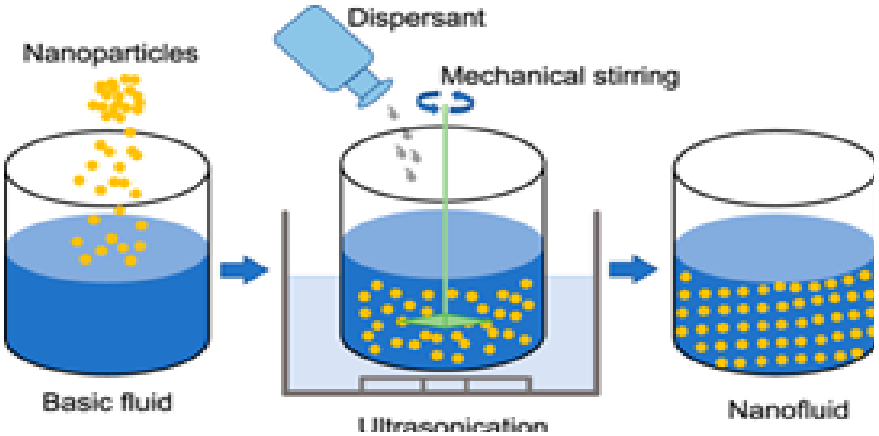



**Figure 1.** Schematic showing preparation of the nanofluids.

## 2.0 Utilizing Nanofluids for Heat Transfer

The application of nanofluids in industrial cooling presents a significant opportunity to reduce emissions and save energy[18,19]. The dependence of the fluid's thermophysical properties-such as viscosity, thermal conductivity, and specific heat-on temperature was ascertained through experimental observations[20,21]. The fluid's effective specific heat increased significantly with the discovery of the indium nanoparticles melting-freezing phase transition[22,23]. The topic of thermal diffusivity has only been addressed in this one paper; these investigations permit the continuation of industrial cooling applications even in the absence of a comprehensive knowledge of all the principle involved in heat transmission in nanofluids[24,25]. The increased use of battery-powered gadgets like laptops and cell phones in this new era of energy consciousness, along with the dearth of renewable energy sources, has highlighted the necessity of effective technical management of energy resources[26,27]. Nanofluids have been shown to function as smart fluids under certain conditions. Furthermore, coolants for emergency cooling systems might be made from nanofluids, which would increase power plant safety due to their ability to rapidly cool heated surfaces[28,29]. The variable number of nanoparticles eliminated by the boiling vapor is a disadvantage of using nanofluids in a power plant system[30,31].

## 3.0 Utilizing Nano Fluid in Automotive

The synthetic high-temperature heat transfer fluids used in conventional automotive thermal systems, including engine oils, automatic transmission fluids, coolants, lubricants, radiators, air conditioning, and heating systems, lack the necessary heat transfer qualities for the purposes for which they are designed[32,33]. These nanofluids enhanced heat conductivity, which the nanoparticles caused to manifest, may be advantageous. Automobile makers must lower the energy required to overcome wind resistance when driving in order to enhance their vehicles aerodynamics and, as a result, increase fuel efficiency[34,35]. This is partly explained by the big radiator in front of the engine, which is positioned to take full advantage of the cooling power of the air reaching it. The radiators might be placed more strategically and made smaller by using nanofluids as coolants[36,37]. Truck engines higher efficiency allows them to run at higher temperatures and with smaller coolant pumps, allowing for higher horsepower levels while still adhering to strict emission regulations[38,39]. To find out if nanofluids harm radiator material, they have constructed and calibrated a device that mimics radiator coolant flow[40,41]. At the moment, they are investigating and assessing how different nanofluids impact the material loss of common radiator materials. Using weight loss data, the erosion of radiator material is computed as a function of impact angle and fluid velocity[42,43].

## 4.0 Utilizing Nano Fluid in Electronic

Chips used in computers and other devices are cooled using nanofluids. They are also utilized in various electrical applications that are based on microfluidics. Rapid heat dissipation is necessary, which hinders the creation of smaller microchips[44,45]. Because of their excellent heat conductivity, nanofluids can be utilized to cool liquid computer chips. The OHP's metal pipe system needed to have glass or plastic added to it for researchers to be able to see the oscillation[46]. Though glass or plastic can alter the system's thermal transfer characteristics, OHP systems are usually composed of copper[47]. This affects the device's operation as well as the precision of the testing results. Although OHPs and nanofluids are not novel materials, the combination of their properties allows the nanoparticles to be entirely suspended in the base liquid, maximizing their potential for heat transmission[48]. High performance conductors with an improved CHF are nanofluids because they exhibit a considerable temperature-dependent thermal conductivity and a nonlinear concentration-to-thermal conductivity relationship[49]. Because the liquid and vapour phases are travelling in the same direction, the OHP converts huge heat from a high-power device using the kinetic energy of fluids[50].

## 5.0 Utilizing Nano Fluid in Biomedical

Cutting-edge efforts are being made to facilitate drug discovery processes, monitor and manage target-cell responses to pharmacological stimuli, and comprehend biological cell activities in order to develop integrated micro or nano-drug delivery systems[51]. While the high and low phenomenon is a hallmark of conventional drug delivery, micro devices improve the precision of subcutaneous and implanted drug delivery systems[52]. Because of this, the drug's blood concentration increases, peaks, and then decreases as a result of metabolism each time a therapeutic dose is administered in the conventional way. Nanotechnology-based drug delivery systems facilitate prolonged, controlled drug release. The intended medication concentration will be maintained during the therapeutic window throughout the duration of its necessity[53]. A recent attempt combines medicine administration with cancer imaging by utilizing particular properties of particular nanofluids. Iron-based nanoparticles will be used in this effort to deliver medication or radiation therapy to cancer patients[54]. The particles are to be directed toward a tumour up the bloodstream using magnetic nanofluids. A major drawback of current cancer therapy approaches is that they let large local doses of radiation or medication to be administered without endangering neighbouring healthy tissue[55].

## 6.0 Conclusion

Nanofluids are important materials with a wide range of uses, including detergency and heat transport. The biomedical industry has long employed colloids, or nanofluids, and this application will only increase in the future. Additionally, the efficacy of nanofluids as smart fluids has been established. Thorough research is necessary to understand the issues with nanoparticle settling, erosion potential, and aggregation in the applications. To maximize the generalizability of experimental data, nanofluids form, size distribution, particle size, and clustering must all be well described. Once the physics, engineering, and potential of nanofluids are fully investigated, large-scale reproduction and a variety of applications may be feasible. Colloids are nanofluids, and their application in biosciences and biomedical engineering is expected to increase. Further research on nanofluids production and use is still required to enable the predicted usage of these materials. The features of nanofluids in the applications under study have yielded a wealth of new knowledge, nevertheless, and we are moving closer to developing more compact and efficient systems that will improve the quality of the environment.

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