Journal of
Chemical Engineering & Process Technology

Bucak J Chem Eng Process Technol 2011, 2:1
DOI: 4172/2157-7048.1000e101

Editorial Open Access

Importance of Defining when Applying

Seyda Bucak

Yeditepe University, Department of Chemical Engineering, Istanbul, TURKEY

There is a huge increase in the number of papers published in the field of nanotechonogy, especially concerning the use of nanoparticles. Although there are numerous papers on nanoparticle synthesis and characterization, most researchers working on the application of nanoaparticles do not concern themselves with well-defining the nanoparticle systems that they are using. This leads to premature conclusions and results in lack of reproducibility of data.

Nanoparticles can be synthesized via different routes, such as chemical reduction, oxidation, gas phase condensation, plasma techniques, laser, etc. These methods lead to formation of different types of particles in terms of their size, morphology and crystal structure. If these particles are then to be suspended in a solvent, a suitable stabilizer such as a surfactant or a polymer may be required. Since the 1990's, there are numerous papers describing synthesis of a variety of nanoparticles and concurrently, several papers on the application of nanoparticles. As the biggest 'leap' was in fact going from micron sized particles to nanoparticles, the importance of well-defining these particles are overlooked.

Although nanoparticles are used in vastly different fields of science, from medical to forensic science, major applications of nanoparticles in engineering passes from use of nanofluids. The increase in the number of articles containing the only keyword 'nanofluid' is given in Figure 1.

A nanofluid can be schematically shown as composed of a core particle with a radius r, surrounded by a stabilizing layer with thickness δ, which is suitable to suspend the particle in a solvent (Figure 2). Although macroscopically, nanofluids appear to be one phase systems, they are in fact two phase systems where a solid particle is suspended in a liquid carrier.

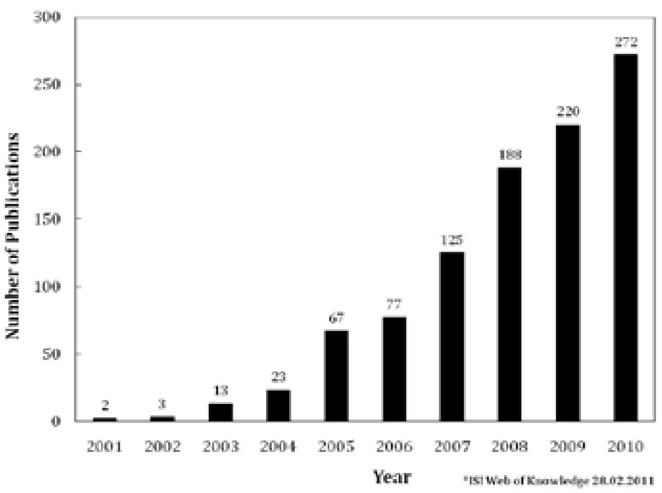

Figure 1: Number of published research articles on nanofluids between 2000 and 2010.

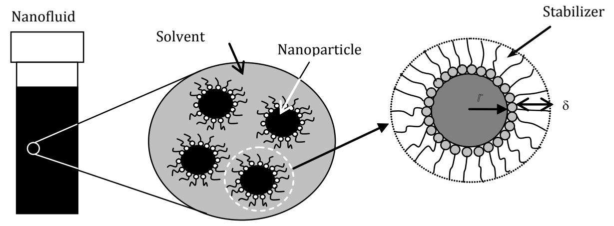

Figure 2: Schematic representation of a nanofluid.

In several studies on application of nanofluids composed of metal (e.g. Al, Au), metal oxide (CuO, Fe_3O_4), inorganic ($CaCO_3$, $Ca_3(PO_4)_2$) or core-shell (Au on Ag, CuO on Cu) nanoparticles, the especially the information on the stabilizer type of the nanoparticle and the size and morphology information is missing in publications. Both the size and the stabilizer will in the simplest case affect the viscosity of the nanofluid, leading to changes in the way that the fluid behaves upon change in environment, such as temperature.

Magnetic properties of magnetic nanoparticles are very much dependent of the particle core dimensions. For example, although within the single-domain crystal size range (i.e. < 35 nm), magnetic force acting on the particle increases linearly with size, increasing the size further results in a switch of superparamagnetism to paramagnetism which decreases the magnetic susceptibility of the nanoparticle. In addition, the presence of other iron oxide impurities largely affect the magnetic susceptibility, hence should be carefully characterized for magnetic fluid applications.

Size of the particles is another determining factor in fluid thermal properties. Thermal conductivity of nanofluids is strongly dependent of particle size as well as the nature of the particle. Because the nature of the particle has a strong contribution to thermal conductivity, the effect of size is often underestimated.

***Corresponding author:** Seyda Bucak, Yeditepe University, Department of Chemical Engineering, Istanbul, TURKEY, E-mail: seyda@yeditepe.edu.tr

Received March 03, 2011; **Accepted** March 04, 2011; **Published** March 07, 2011

Citation: Bucak S (2011) Importance of Defining when Applying. J Chem Eng Process Technol 2:e101. doi:10.4172/2157-7048.1000e101

All these factors strongly contribute to flow dynamics of nanoparticles. In order to obtain a suspension with desired properties and to be able to optimize the properties of nanofluids, instead of trial-and-error, proper characterization of systems should be performed, followed with developing coherent relationships between nanoparticle structure and behavior in solution.

It is of utmost importance that the reviewers and editors do not proceed with publishing nanoparticle application papers without the proper definition of nanoparticles in terms of their stabilizer, size, morphology and crystal structure. At the interface of science and engineering, technology should root itself to a strong scientific base and from there flourish into vast branches of engineering.