Nanotechnology brings an energy saving revolution

Although there is still some debate about the cause and significance of Climate Change, it has certainly led to a much greater focus on finding ways to reduce energy consumption across all aspects of society. This article describes a revolutionary new approach to improving energy efficiency by using technology at the leading edge of today's science.

Space heating accounts for over 60% of energy consumption in our homes and almost half the energy used in the services sector goes the same way. Whilst there are many different options for heating our homes and offices, by far the most common approach is to install a gas-fired boiler connected to radiators by pipes carrying a flow of heated water. Many new systems are coming into use – such as ground-source heat pumps, biomass, solar - but they all need a way of moving the heat from the point where the energy is consumed to the place where it is actually needed.

Is water the best option for transferring heat?

Of course, water is a logical choice for the heat transfer fluid in a space heating system - it is easy to obtain, relatively cheap and non-hazardous. However, it has a freezing point that is above the minimum temperatures frequently encountered even in a relatively mild climate like the UK and it also causes corrosion within the heating system over the long term – unless treated with an inhibitor, at additional cost.

One of the characteristics of water that is not often discussed is the fact that although it conducts heat quite effectively, there are a many other types of substance that that do the job a lot better. A prime example is metal. For example, the thermal conductivity of aluminium is about 400 times that of water and copper is more than 600 times better! If a frost inhibitor (such as glycol) is added to water, this makes the heat transfer efficiency of the system even worse as the thermal conductivity of glycol is less than half that of water.

So, in simple terms, we would expect our space heating system to work more efficiently if the heat transfer fluid behaved more like a metal than just water alone.

Here comes the revolution – Nanotechnology

Over the last decade, there has been intensive research into the behaviour of substances that contain extremely small particles. Nanotechnology is the science and engineering of working at the nanoscale, where the individual particles are 1-100 nanometres in size. (It's hard to imagine the size of a nanoparticle, but there are about 25,400,000 nanometres in an inch.)

The behaviour of substances that contain nanoparticles can be quite different from normal expectations and exhibit complex characteristics that can be beneficial in the right type of application. Nanotechnology is already used to create lightweight strong materials for applications such as boat hulls, sporting equipment, automotive parts and dental implants. Some pharmaceutical products have been reformulated with nano-sized particles to improve their absorption and make them easier to administer. Nanotechnology is now successfully used in laser-based cancer treatments where the bad cells can be killed off without damaging the surrounding healthy tissue.

Nature is full of nanofluids. A good example is blood - a complex biological nanofluid where different nanoparticles accomplish different functions. It is the intelligent application of nanofluid technology that will bring about a revolution in space heating systems by making the heat transfer fluid behave more like a metal whilst maintaining the good characteristics of water.

Using a nanofluid to transfer heat

Numerous tests have been conducted in laboratories around the world to assess the heat transfer properties of nanofluids where minute particles of aluminium or copper are suspended in a base fluid. These experiments have covered a wide range of operating temperatures and included a study of the impact on viscosity.

The laboratory experiments have been backed up by theoretical studies and it has been found that the thermal characteristics of nanofluids often defy the classical equations that have been used in the past – thus opening up a whole new world of possibilities.

The overall outcome of this research has shown that it is possible to significantly enhance the heat transfer properties of a fluid by introducing nanoparticles. Early practical applications of this have been mainly targeted at cooling applications, for example within high-performance computer hardware and motor vehicles.

How to harness the benefits of Nanotechnology in space heating systems

If a nanofluid can improve the efficiency of a cooling system by conducting the heat away more efficiently, it follows that the same enhanced heat transfer performance can be used to deliver the heat generated in a gas-fired boiler to the radiators that maintain living and working spaces at a comfortable temperature. Like the laboratory experiments mentioned above, this appears to defy the conventional rules of thermodynamics as it is possible to reduce gas consumption by 20-35% just by changing the composition of the fluid in the system.

The first commercial product to deliver energy savings on this scale is Hydromx. This is a patent-protected, biodegradable product which is mixed 50/50 with the water in an existing heating system to improve performance and delivers both a rapid and substantial return on investment. Hydromx not only reduces the energy consumed by the system, but its special formula also includes corrosion and frost inhibitors to offer a unique three-in-one package of benefits.

Hydromx is suitable for any size of system, from a small house to a large office block or shopping mall. The same heat transfer properties that produce energy savings in a conventional space heating system also enhance the performance of solar heating systems. This is all due to the special properties of the nanofluid component in Hydromx which makes water perform more like a metal when transferring heat.

Hydromx is a big revolution brought about through the clever use of tiny particles. It is available exclusively in the UK through PBA Energy Solutions Ltd and its authorised partners and resellers.

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