

NANOFLUID WITH INCREASED THERMAL CONDUCTIVITY APPLICABLE TO HEAT TRANSMISSION SYSTEMS

DESCRIPTION OF THE INVENTION

The invention consists in a heat transfer fluid for high temperature applications ($15^{\circ}\text{C} < T < 400^{\circ}\text{C}$). This nanofluid consists of a mixture of diphenyl/diphenyl oxide doped with nanoparticles made of carbon and stabilisers, which improves on the thermal conductivity of existing heat transfer fluids by up to 30%. The invention is useful for industrial applications that employ heat transmission/exchange systems.

Heat exchange fluids are fluids used to transport heat in a number of industrial applications. These fluids are employed to transport energy in the form of heat from the point where the heat is generated (burners, cores of nuclear reactors, solar farms, etc.) to the system that is going to use it (thermal storage systems, steam generators, chemical reactors, etc.). The most commonly used thermal fluids are water, ethylene glycol, thermal oils and molten salts. One characteristic that is common to all of them is their low thermal conductivity, which is what limits the efficiency of the heat exchange systems that use them.

The technology presented here overcomes these limitations and increases the thermal conductivity by

adding an exact proportion of nanoparticles consisting of carbon and other additives to the base fluid (diphenyl/diphenyl oxide), while maintaining the original range of operating temperatures of the base fluid ($15^{\circ}\text{C} < T < 400^{\circ}\text{C}$). In this way it becomes possible to obtain increases of up to 30% in the thermal conductivity of the base fluid. All this is achieved without compromising the stability of the fluid and with a moderate increase in its viscosity, which means that it does not give rise to any problems with pumping, the precipitation of nanoparticles or the obstruction of conduits.

The method employed to produce the nanofluid is easily scalable to the industrial level and both the nanoparticles and the stabilisers used are inexpensive. The additional cost of the nanofluid, produced on an industrial scale, in addition to the base fluid is less than 1 €/litre (<5% of the price of the base fluid).

The technology has been developed for thermal oils based on mixtures of diphenyl/diphenyl oxide, but can be extrapolated to other types of heat transport fluids.

SECTORS FOR COMMERCIAL APPLICATION

The technology is useful in all those industrial applications that use heat transmission systems, such as:

- Solar power plants.
- Nuclear power plants.
- Combined-cycle power plants.
- Heating.

TECHNICAL ADVANTAGES AND COMMERCIAL BENEFITS

The nanofluid offers the following advantages:

- It can be used over a wide range of temperatures: from 15°C to 400°C .
- It offers good stability over time within the range of operating temperatures. The nanoparticles do not precipitate out and, therefore, the nanofluid maintains its properties.
- The viscosity of the nanofluid varies only moderately in comparison to the base fluid, and therefore it does not require a high extra energy expenditure to pump the fluid.
- It offers enhanced thermal conductivity properties (an increase of up to 30%).
- The use of the nanofluid does not impose any significant changes in installations where the base fluid is already used.
- The new nanofluid is based on a heat transfer oil (diphenyl/diphenyl oxide) that is widely employed in

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the industry.

- The materials needed to prepare the nanofluid are abundant, readily available and economical.

STAGE OF DEVELOPEMENT OF THE TECHNOLOGY

The thermal and rheological properties have been tested in laboratory trials and their stability has been proven in a thermohydraulic loop.

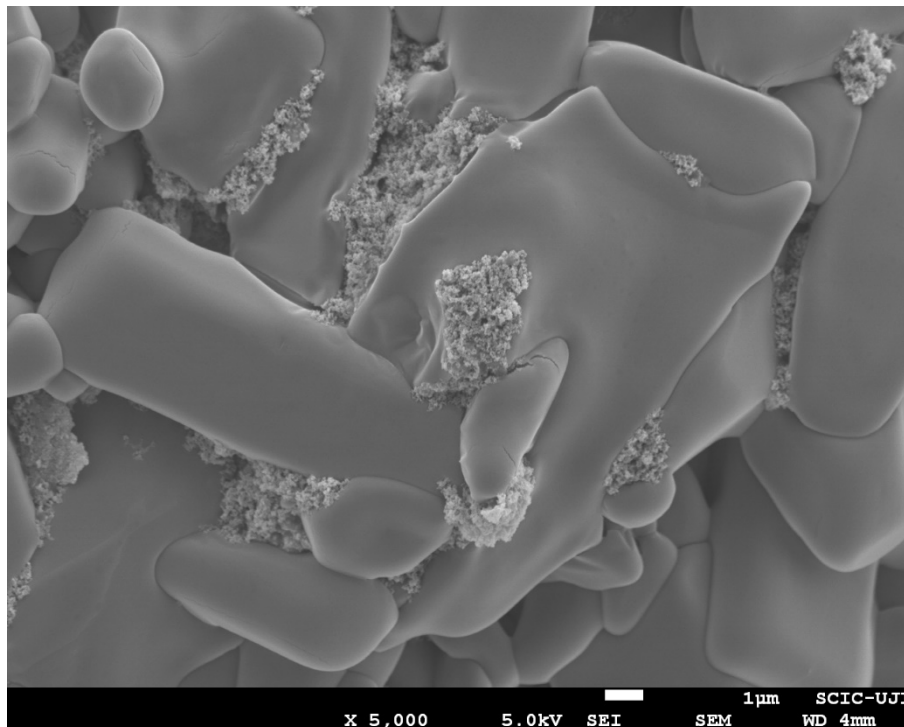
INTELLECTUAL PROPERTY RIGHTS

A Spanish patent has been applied for with the reference P201430736 and filing date 05/20/2014. In process of internationalization by PCT.

COLLABORATION SOUGHT

- License agreement for use, manufacturing or commercial exploitation.
- R&D for further development of the invention or for exploring its applications in other industrial sectors.

RELATED IMAGES



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