Smart nanomaterials for green air conditioning & concentrated solar power applications

M. Maaza[1-2]

[1]UNESCO-UNISA Africa Chair in Nanosciences-Nanotechnology, PO Box 392, Muchleuneuck, College of Graduate Studies, University of South Africa, Pretoria-South Africa , [2]Nanosciences African Network (NANOAFNET), iThemba LABS-National Research Foundation, PO Box 722, Somerset West, Western Cape Province, South Africa

Prof. Malik Maaza: Maaza@tlabs.ac.za

Abstract

•The Global energy demand for air conditioning is expected to triple by 2050, requiring new electricity capacity the equivalent to the combined electricity capacity of the US, the EU and Japan today. The global stock of air conditioners in buildings is expected to grow to 5.6 billion by 2050, up from the current1.6 billion which almost corresponds to 10 new ACs sold every second for the next 30 years. In line with the SDGs, Smart nano coatings such as those based on thermochromic VO_2 could assist in addressing such a challlenge in minimizing the energy load. Biomimicking the Gemsbock heat management approach, this family of VO_2 based nanomaterials exhibit 1st order Mott phase transition. They are semiconductor and metallic at low & high temperature respectively. Hence Infrared transparent & infrared opaque at low & high temperatures respectively. Consequentially, Solar heat dynamic windows coated with such VO_2 temperature responsive solar heat nanocoatings allow smart active solar heat management & green air-conditioning. Likewise, it is demonstrated that such VO_2 materials are multifunctional with potential applications in ultrafast optoelectronics and femtosecond nanophotonics.In addition, in form of nanosuspensions i.e nanofluids can exhibit an enhanced thermal conductivity allowing an improved thermal transfer of the coolant fluid in Concentrated Solar Power (CSP) based systems and henceforth working in tandem with CSP Selective Solar Absorbers.This contribution is intending to highlight the versatility of theVO2 based smart nanocoatings for green air-condioning & novel approach for the engineering of nanofluids & selective solar absorbers for CSP technology.

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