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Nano-Based Thermal Insulating Materials for Building Energy Efficiency

Aerogel- Vacuum Insulation Panels (VIPs)

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Abstract:

The construction industry consumes a lot of energy, and its demand is expected to grow in the next decades all over the world. Nanotechnology may be used to generate new advanced high performance insulating materials with reduced thermal conductivity as a replacement for existing thermal insulators. This paper intends to give a state-of-the-art review of aerogels and vacuum insulation panels in order to provide a scientific overview of the most promising nano-based thermal insulation material for building applications in order to achieve energy efficiency. Firstly, the paper is used an inductive inference approach and includes reviewing general characteristics of these two nano-based insulating materials, as well as their types, applications and qualities that affect building energy consumption. Then, the analytical approach to analyze some international examples of buildings applications to illustrate the potential energy efficiency with using nano based thermal insulators. It is found that, aerogel thermal insulation products have two to three times less thermal conductivity than typical thermal insulation materials; either for opaque insulators or the transparent-translucent one. Regarding Vacuum Insulation Panels (VIPs); it can increase building energy efficiency by 8 to 10 times with very thin layers.

Keywords:

Energy Consumption, Energy Efficiency, Nanotechnology, Nanomaterials, Thermal Insulation Materials

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