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Nanotechnology and the Development of Novel Materials for Utilization in Energy-Efficient Buildings

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Nanotechnology offers the potential of being able to tailor-make materials with desired properties for miscellaneous functions. This versatile and powerful ability could be exploited to a much larger degree in the building sector, e.g. in the development of energy-efficient buildings which are becoming more in demand according to the world's ever increasing focus on scarcity and abundance of material resources, energy efficiency, environmental impact, non-polluting and renewable energy sources and carriers. Hence, aspects related to thermal transport, solar radiation, moisture transport, weather protection, durability, energy harvesting & storage possibilities and various other building physical processes, especially with respect to the building envelope, will then be important to address properly. Examples of these novel material developments applying nanotechnology investigated in our studies are vacuum insulation panels and nano insulation materials as super insulation materials for substantially reduced thermal transport, aerogel-incorporated concrete and mortar for a construction material with higher thermal resistance, translucent aerogel windows and walls with utilization of the solar radiation and lowered heat loss through the building envelope, low-emissivity materials to decrease the thermal radiation loss, anti-reflective and solar-selective coatings for different solar radiation utilizations, snow- and ice-avoiding material surfaces for various purposes like e.g. to avoid snow and ice accumulation on solar cell panels, lightweight glass materials for windows and glazing structures, phase change materials for releasing deficit and storing excess energy when needed, electrochromic materials for regulation of the solar radiation transmittance and building integrated photovoltaics for harvesting solar energy within the building envelopes.

Biography:

Bjorn Petter Jelle is a professor at the Norwegian University of Science and Technology (NTNU) and a chief scientist at SINTEF Building and Infrastructure. Dr. Jelle's background is as a physicist, chemist and material scientist and examples of current work fields include building physics, materials science, solar radiation, thermal radiation, climate exposure, accelerated climate ageing, solar cells, building integrated photovoltaics, high performance thermal insulation materials, nano materials and electrochromic materials for energy-efficient windows.