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Optimum Switch Temperature for Phase Change Materials in Buildings

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Abstract : To avoid or at least to attenuate the global warming, it is essential to reduce the energy consumption of the buildings where the biggest potential of savings exists. The impending danger can come from the increase in the needs of air conditioning not only because of the climate warming but also the fast equipping of emerging or developing countries. Passive solutions exist and others are in promising development and therefore, must be applied wherever it is possible. Even if they do not always avoid the resort to an active cooling (mechanical), they allow lowering the load at an acceptable level which can be possibly taken in relay by the renewable energies. These solutions have the advantage to be relatively less expensive and especially adaptable to the existing housing. However, it is the internal convection resistance that controls the heat exchange between the phase change materials (PCM) and the indoor temperature because of the very low heat coefficients of natural convection. Therefore, it is reasonable to link the switch temperature Tm to the temperature of the substrate (walls and ceiling) because conduction heat transfer is dominant. In this case, external conditions (heat sources such as solar irradiation and ambient temperatures) and conductivities of envelope constituents are the most important factors. The walls are not at the same temperature year round; therefore, it is difficult to set a unique switch temperature for the whole season, making the average values a key parameter. With this work, the authors' aim is to see which parameters influence the optimum switch temperature of a PCM and additionally, if a better selection of PCMs relating to their optimum temperature can enhance their energetic performances.

Keywords : low energy building, energy conservation, phase change materials, PCM
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