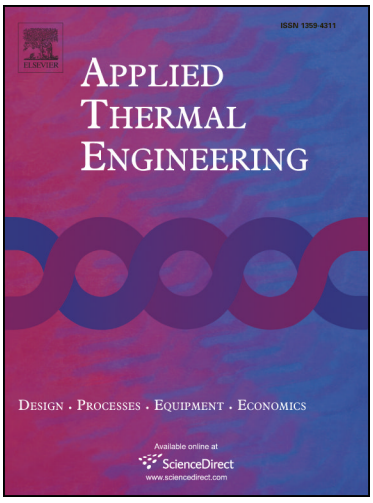

Research Paper

Guidelines for the specification of a PCM layer in Firefighting Protective Clothing Ensembles

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Guidelines for the specification of a PCM layer in Firefighting Protective Clothing Ensembles

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Abstract

Phase change materials are increasingly seen not only as a solution to reduce the mismatch between demand and supply of energy, but also as an adequate tool for heat management. Firefighters usually encounter high heat flux exposures, which can cause severe burns. The addition of a PCM layer into a typical firefighting garment ensemble can be used to mitigate this effect, increasing the time to second-degree burns. A numerical approach was used to investigate the effect of PCM latent heat, mass, melting temperature, and position within the garment ensemble, to assess the implications in terms of thermal performance and time to second-degree burns, under high-, medium- and low-intensity heat exposures. Guidelines for the specification of PCM characteristics are provided with respect to the heat exposure scenario considered, to enable informed decisions regarding the choice and features of the PCM, in function of the intended application and required time-windows without burns. The data discussed in this work provide insight on how a PCM layer influences the thermal burden on a firefighter, which enables the estimation of optimal PCM masses, and thus the minimization of the load to be carried by the firefighter, and the costs associated with the integration of high loads of PCM in a garment.

Keywords: PCM application, firefighting garment, phase change material, finite element modelling, FEM, time to second-degree burns

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