Thermal conductivity and compressive stress at 10% strain vs. density and thickness of foamed polystyrene panels

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ABSTRACT

On the basis of measurement of thermal conductivity, λ, and compressive stress at 10% strain, σ_{10}, carried out for a few hundred foamed polystyrene panels with different densities, ρ, and thicknesses, d, we have fitted some analytic relations between compressive stress at 10% strain and density, and also among thermal conductivity, density, and thickness. We have used the general nonlinear least squares approximation for the fitting, assuming measuring errors in every quantity, as well as measuring the correlation between panel density and thickness. In case of the dependence $\lambda(\rho,d)$, the fitting has been executed in three dimensions. As a result, we obtained that the foamed polystyrene thermal conductivity at constant density depends on the panel thickness. We have also shown that the correlation between σ_{10} and ρ, and also among λ, ρ, and d, that has been confirmed by the prediction curves and surfaces, is sufficient to enable determining σ_{10} merely by the polystyrene density measurement and λ by the density and thickness measurement. It can be useful to improve legal testing or acceptance sampling of polystyrene panels since one can measure the density and thickness far easier than the thermal conductivity or compressive stress.