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A comprehensive study on thermal conductivities of wavy carbon nanotube-reinforced cementitious nanocomposites

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Abstract. The thermal conductivities of cementitious nanocomposites reinforced by wavy carbon nanotubes (CNTs) are determined by the effective medium (EM) micromechanics-based method. The nanocomposite is composed of sinusoidally wavy CNTs as reinforcement and cement paste as matrix. The interfacial region between the CNTs and cementitious material is considered in the analysis. The effects of volume fraction and waviness parameters of CNTs, interfacial thermal resistance, type of CNTs placement within the matrix including aligned or randomly oriented CNTs, cement paste properties on the thermal conductivity coefficients of the nanocomposite are studied. The estimated values of the model are in very good agreement with available experimental data. Two parameters of CNT waviness and interfacial region contributions should be included in the modeling to predict realistic results for both aligned and randomly oriented CNT-reinforced nanocomposites. The results reveal that thermal conductivities K_{22} (transverse in-plane thermal conductivity) and K_{33} (longitudinal in-plane thermal conductivity) of the nanocomposites are remarkably dependent on the CNT waviness. Also, it is found that the CNT waviness moderately affects the thermal conductivity of a