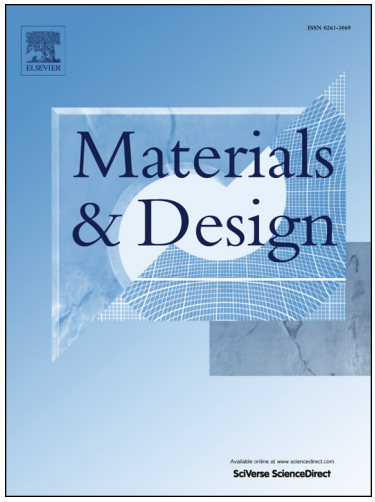

Heat resistance, crystallization behavior, and mechanical properties of polylactide/nucleating agent composites

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Heat resistance, crystallization behavior, and mechanical properties of polylactide/nucleating agent composites

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Abstract: The Vicat softening temperature, melt and crystallization behavior, as well as the mechanical properties of polylactic acid (PLA)/nucleating agent (TMC-328) composites with different TMC contents were investigated. PLA/TMC composites had a modulus–temperature curve characteristic of polymers in three phases, and these phases shifted with increasing TMC concentration. Non-isothermal differential scanning calorimetry was applied to investigate the heat resistance mechanism of PLA. The heat resistant temperature was positively correlated with the degree of crystallinity, crystallization rate constant, and cold crystallization rate constant. Moreover, the arrangement and movement of molecular chains influenced the heat resistance of PLA, with an increased rigid amorphous fraction improving the heat resistance between the glass transition and cold crystallization temperatures. In conclusion, addition of the nucleating agent enhanced the crystallizability of PLA, thereby improving the heat resistance of PLA. With 0.2% (wt/wt) TMC, the Vicat softening temperature reached 134°C, about 2.1 times that of the neat PLA (64.7°C). An increase in the dose of nucleating agent had little impact on the tensile strength of PLA/TMC composites, but the tensile elastic modulus was increased with a higher dose of nucleating agent, after an initial decrease.

Keywords: polylactic acid; nucleating agent; heterogeneous nucleation; crystallization; heat resistance.

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