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Photothermal heating as a methodology for post processing of polymeric nanofibers[1] RUSSELL GORGA, LAURA CLARKE, JASON BOCHINSKI, VIDYA VISWANATH, SOMSUBHRA MAITY, JU DONG, GABRIEL FIRESTONE, North Carolina State University — Metal nanoparticles embedded within polymeric systems can be made to act as localized heat sources thereby aiding in-situ polymer processing. This is made possible by the surface plasmon resonance (SPR) mediated photothermal effect of metal (in this case gold) nanoparticles, wherein incident light absorbed by the nanoparticle generates a non-equilibrium electron distribution which subsequently transfers this energy into the surrounding medium, resulting in a temperature increase in the immediate region around the particle. Here we demonstrate this effect in polymer nanocomposite systems, specifically electrospun polyethylene oxide nanofibrous mats, which have been annealed at temperatures above the glass transition. A non-contact temperature measurement technique utilizing embedded fluorophores (perylene) has been used to monitor the average temperature within samples. The effect of annealing methods (conventional and photothermal) and annealing conditions (temperature and time) on the fiber morphology, overall crystallinity, and mechanical properties is discussed. This methodology is further utilized in core-sheath nanofibers to crosslink the core material, which is a pre-cured epoxy thermoset.

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