Photothermal patch films based on rubber nanocomposites of tungsten bronze nanorods with enhanced tensile elongation

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We present rubber nanocomposites of tungsten bronze nanorods (TBNRs) and ethylene propylene diene monomers (EPDM). The combination of these components allows the simultaneous enhancement in the mechanical and photothermal properties at low filler contents. respectively, TBNRs were capped with oleylamine, which has a chemical structure similar to EPDM, making the TBNRs compatible with the bulk EPDM matrix. The TBNRs absorb a wide range of near-infrared light because of the sub-band transitions induced by alkali metal doping. Thus, the nanocomposites of TBNRs in EPDM showed enhanced photothermal properties owing to the light absorption and subsequent heat emission by in-direct bandgap transition in the TBNRs. Noticeably, the nanocomposite with 3 wt% TBNRs presented significantly enhanced tensile strain because of the alignment of the nanorods during tensile elongation. The photothermal and mechanical properties of these nanocomposites make them promising materials for various applications such as in fibers, foams, and clothes with cold weather resistance, patch or mask-like films.