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Polymer nanocomposite luminescent films for solar energy harvesting made by concurrent multi-beam multi-target pulsed

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There are increasing public and private pressures for the adoption of solar power technologies. Because of their adaptability and attractive appearance, there is a burgeoning interest in luminescent solar concentrator (LSC) devices for use in buildings. LSCs are large polymer/glass plates filled/coated with luminescent materials that absorb the sunlight and re-emit it at a longer wavelength. The plate acting as an optical waveguide redirects the re emitted radiation energy to small edge attached photovoltaic (PV) cells to generate electricity. Wide use of LSCs has been hindered by the lack of suitable luminescent coatings. The authors report on the polymer nanocomposite films doped with the nanoparticles of rare earth (RE) doped fluoride phosphor NaYF4:Yb3+, Er3+ (molar proportion: a=3% of Yb3+, b=1 to 5% of Er3+ and [100%-(a+b)] of Y3+) for efficient luminescent solar concentrators (LSCs). The films are deposited using the concurrent multi-beam multi-target pulsed laser deposition of the inorganic target material and matrix assisted pulsed laser evaporation of the polymer (MBMT-PLD/MAPLE). The advantage is a broad absorption spectrum covering a significant portion of the solar radiation spectrum, high spectral conversion efficiency and low reabsorption due to minimal overlap between the absorption and emission spectra (large stokes shift). The preliminary results show that the polymer PMMA matrix preserves its chemical integrity, structure and uniformity after MAPLE and the luminescent phosphor nanoadditive NaYF4: Yb3+, Er3+ preserves its chemical integrity and crystalline structure as well down conversion optical properties.

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