

Multi-Color Fluorescent Polyimides with Very Large Stokes Shifts and Their Performance for Solar Spectral Conversion

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Polymeric materials exhibiting fluorescent emission are expected to be applied for wavelength down-conversion in a wide range of applications such as flat panel displays, photovoltaic devices, and crop cultivators. However, conventional fluorescent polymers consisting of π -conjugated sequences do not have sufficient thermal, environmental, and radiation stabilities.

We have recently reported that synthesis and properties of a series of imide compounds and polyimides containing one or two $-OH$ groups which form ideal intramolecular hydrogen bondings between the $-OH$ and $C=O$ groups. They exhibit strong and tunable multi-color (blue, green, yellow, to deep red) fluorescence with very large Stokes shifts ($\nu=7655\sim11394\text{ cm}^{-1}$) via excited-state intramolecular proton transfer (ESIPT). Moreover, the corresponding deprotonated mono- and di-anion species were formed in basic conditions, which were characterized by visible halochromism in their absorption and emission spectra. Copolymer films derived from blue- and red-fluorescent polyimides exhibit strong absorption in the UV region, and the transmission intensities in the blue and orange regions are obviously enhanced by $\sim 16\%$ due to the fluorescent emission. Judicious design of highly fluorescent polyimides are promising for fabricating tough and flexible wavelength converters which efficiently absorb UV component of solar or LED light and emit preferable visible radiation without consuming external energy.

References

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