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Ionic Liquid-based Luminescent Composite Materials

Takuya Nakashima, Yoshiyuki Nonoguchi and Tsuyoshi Kawai
Graduate School of Materials Science, Nara Institute of Science and Technology,
8916-5 Takayama, Ikoma, Nara 630-0101, JAPAN
T. Nakashima, e-mail: ntaku@ms.naist.jp

Room-temperature ionic liquids are receiving much interest as environmentally benign solvents for organic chemical reactions and separations, and recent developments include their use for materials chemistry.[1] Since ionic liquids have been also investigated as the electrolytes for dye-sensitized solar cells and light-emitting electrochemical devices, their composites with semiconductor nanocrystals (NCs) which exihibit unique photophysical properties are among the most promising materials for future optoelectronic applications. We have recently succeeded in the extraction of luminescent CdTe NCs from water to hydrophobic ionic liquids without any extractors.[2] The CdTe NCs are stably dispersed in the ionic liquid and show characteristic enhancement in the photoluminescence intensity and the thermal stability. Figure 1 shows temperature(phase)-dependent photoluminescence of the CdTe NCs. In water, the emission from CdTe NCs is almost quenched at the low-temperature, whearas it is further enhanced in the ionic liquid by decreasing temperature. The apparent emission quantum yield reaches up to almost unity below 100 K, which enables us to investigate the intrinsic band structure of CdTe NCs.[3] An ionic liquid based-monomer which possesses an acrylate group[4] also extracts the CdTe nanocrystals from water. The obtained ionic lqiuid solution gives a quantum dot-polymer composite with strong photoluminescence by the radical polymerization of the ionic liquid-based monomer (Figure 2).[5]

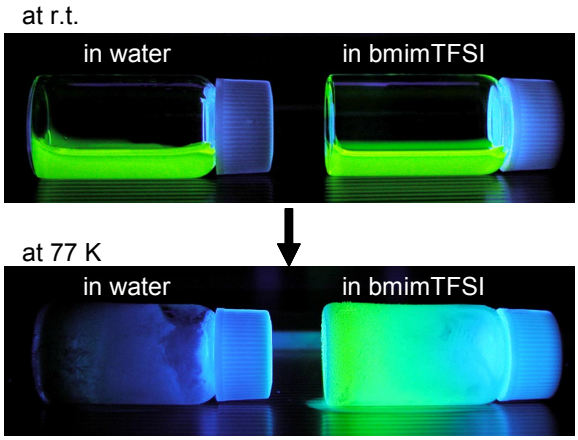

Figure 1. Cooling effect on the emission of CdTe NCs (left) in water and (right) in bmimTFSI at (upper) room temperature and (lower) 77 K.

Figure 2. Ionic liquid-based poymer-CdTe NCs composites.

References

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