

Advanced Organic Heat Transfer Materials Constructed by the Photopolymerization of Discotic Liquid Crystals

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Extended Abstract

Rapid advancement in electronic industry necessitates the effective heat management system to enhance the lifetime of devices [1]. Up to now, a tremendous amount of research has been proceeded for the development of thermal conducting composites by incorporating highly thermal conductive additives, where the thermal conductive performances primarily rely on the properties of fillers [2]. However, these polymer composites often show low thermal conductivities despite the large amount of the incorporation of thermal conductive fillers, mainly due to the intrinsic low thermal conductivity of polymeric matrix [2]. Therefore, the development of an organic material with advanced thermal conductivity is important to accomplish good thermal conducting performance of composites even in small amounts of filler loading [3]. In this regard, polymerizable liquid crystal, often called reactive mesogen can be adapted for highly thermal conductive polymeric materials [3]. By the polymerization of liquid crystal molecules with high orderings, a robust polymeric network with high thermal conductivity can be obtained [3]. In this work, Triphenylene-based discotic liquid crystal (DLC) monomers, DLC-vinyl and DLC-SH were synthesized and used for the development of organic heat transfer materials with outstanding thermal conductivity [3]. Based on the physical, chemical, and thermal properties of DLC monomeric mixtures, the content of DLC mixture was optimized and the DLCs were photopolymerized by exposing 365 nm UV at LC state [3]. The fabricated DLC film shows the thermal conductivity value: 1.09 (TPS method) and 2.33 W/mK (LFA method) [3]. Moreover, by polymerizing DLC monomer under a strong magnetic field, the uniaxially ordered DLC films were successfully constructed [3]. The advanced thermal conductivity of DLC-based film should be due to the macroscopically self-assembled DLC mesogens [3]. This work was supported by the BK21 plus, BRL2015042417, and Mid-Career Researcher Program (2016R1A2B2011041) of Republic of Korea.

References

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