Delayed Luminescence Properties of Aromatic Diimide Compounds having Naphthalene, Biphenyl and Oxydiphthalic Core Structures.

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[Introduction] Persistent or Long-lived luminescent (LL) materials have been applied to bioimaging, phototherapy, and emergency signs, and most of them for practical and current use are inorganic materials [1]. Recently, metal-free organic LL materials synthesized facilely with low costs are demanded because the inorganic LL materials require the use of rare metals, high temperature processing, and relatively high costs. Thermally activated delayed fluorescence (TADF) [2] and phosphorescence (Ph) [3] of organic LL have long emission lifetimes because they are mediated by the excited triplet (T*) state but it is easily deactivated by local molecular motion and atmospheric triplet oxygen. Hence, it is generally difficult to achieve LL for organic materials at room temperature and in air, even though there is high demand to apply organic LL in the atmospheric condition. Recently, we have found that a series of diimide compounds (MCs) containing naphthalene, biphenyl, and oxydiphthalic core structures exhibit long-lived delayed luminescence (DL) when dispersed in poly(methyl methacrylate) (PMMA). In this study, we investigated the photophysical process of the DL of MCs by spectroscopic techniques.

[Experimental] We have synthesized diimide compounds (NT-MC [4], *s*BP-MC and OD-MC) having 2,3,6,7-naphthalene (NT), 4,4',5,5'-biphenyl (*s*BP), and 4,4'-oxidiphthlic (OD) core structures (**Fig. 1**). These MCs were homogeneously dispersed in PMMA films at a concentration of 0.2 wt% using chloroform solution, and thin solid films were formed on fused silica substrates. Emission spectra during UV irradiation and emission decay curves were measured for these films

Fig. 1 Chemical structures of diimide compounds (MCs).

[Results and Discussion] **Fig. 2** shows the emission spectra of NT-MC, *s*BP-MC and OD-MC. The spectra of NT-MC, *s*BP-MC and OD-MC show only fluorescence peaks around 400 nm during UV irradiation at less than 1 min. After few minutes of irradiation, new emission peaks appeared around 500, 510, and 480 nm, respectively, and the intensity of these peaks increased with increasing the

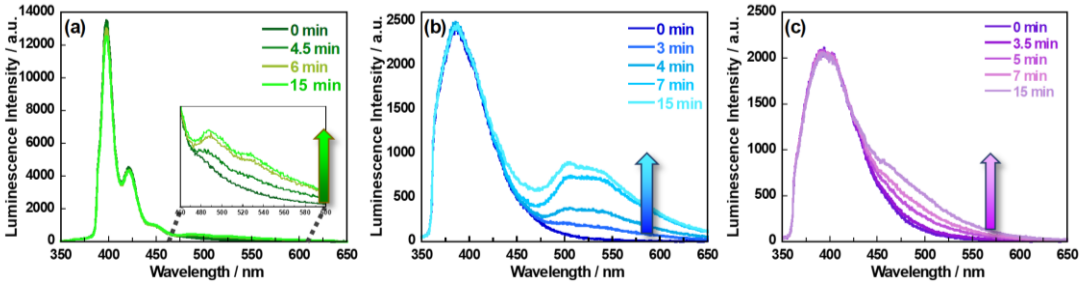

Fig. 2 Emission spectra measured at various elapsed times of UV irradiation for (a) NT-MC (λ_{ex} = 365 nm), (b) *s*BP-MC and (c) OD-MC (λ_{ex} = 340 nm).