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Mechanochromic Delayed Fluorescence Switching in Propeller-Shaped Carbazole–Isophthalonitrile Luminogens with Stimuli-Responsive Intramolecular Charge-Transfer Excited States

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Abstract: Herein, the universal design of high-efficiency stimuliresponsive luminous materials endowed with mechanochromic luminescence (MCL) and thermally activated delayed fluorescence (TADF) functions is reported. The origin of the unique stimulitriggered TADF switching for a series of carbazole–isophthalonitrilebased donor–acceptor (D–A) luminogens is demonstrated based on systematic photophysical and X-ray analyses, coupled with theoretical calculations. It was revealed that a tiny alteration of the intramolecular D–A twisting in the excited-state structures governed by the solid morphologies is responsible for this dynamic TADF switching behavior. This concept is applicable to the fabrication of bicolor emissive organic light-emitting diodes using a single TADF emitter.

Introduction

Solid-state luminescence is a conspicuous area of fundamental and applied research. In particular, smart organic luminescent materials that are capable of switching their emission colors in response to external stimuli, such as mechanical force, heat, and solvent fuming, have attracted great attention toward their applications in sensors, probes, and security and storage devices.^[1] Over the past decade, a wide variety of mechanochromic luminescent (MCL) materials including π -conjugated small molecular dves,^[2] liquid crystals,^[3] polymers,^[4] and organometallic complexes,^[5] which can switch their emission colors (wavelength), intensity, and/or lifetime upon mechanical grinding, shearing, and pressing, have been extensively explored. The stimuli-responsive characteristics of most reported MCL materials primarily originate from the alteration of intermolecular interactions, such as $\pi-\pi$ stacking, J- or H-aggregation, and excimer formation within the condensed states. Accordingly, the photoluminescence (PL) quantum yields (ϕ_{PL}) of such MCL materials are typically rather low due to severe aggregation-caused quenching (ACQ), which restricts their functionality as actual emitters. The development of novel MCL systems that display clear MCL color changes together with high ϕ_{PL} in their aggregated solid states is of vital importance for their future practical applications. Our group

recently reported a highly emissive MCL material based on a donor-acceptor (D-A) electronic system with intramolecular charge transfer (ICT) characteristics and revealed that its MCL behavior originated from changes in the planar and twisted excited-state D-A structures formed in the different solid phases.^[6] In addition, we demonstrated two-color-emissive organic light-emitting diodes (OLEDs) using this D-A-type MCL material as a single fluorescent emitter. Ma and coworkers reported a D-A-type fluorophore with ICT, which exhibited unique multi-color MCL behavior caused by the change in the twisting angles between the D and A units.^[7] Compared with conventional MCL materials that inevitably involve strong intermolecular interactions or stacking, such D-A-type MCL systems induced by variable intramolecular twisting, therefore, have huge potential to demonstrate greater ϕ_{PL} along with definite color changes even in the aggregated states.^[6,7]

Meanwhile, thermally activated delayed fluorescence (TADF) materials have emerged as a promising alternative to traditional fluorescent and phosphorescent emitters in the field of OLEDs^[8,9] and related optoelectronic devices^[10] owing to their ability to produce high internal quantum efficiencies (η_{int}) approaching 100% without using noble metals. To achieve an effective up-conversion of the non-emissive triplet (T_1) into emissive singlet (S1) excitons, TADF materials are required to possess a tiny energy splitting (ΔE_{ST}) between the lowest excited S_1 and T_1 states.^[8,9] The most common strategy for designing efficient TADF molecules is to construct highly twisted D-A structures within a single molecule, rendering them to have spatially separated frontier molecular orbitals without compromising the radiative ICT nature. With remarkable exciton utilization capability and quantum efficiencies, the merging of TADF and MCL functions into the D-A-type molecular systems will be a fascinating approach for the development of highperformance luminous and smart materials devices. Furthermore, the solid-state emission colors and emission lifetimes of such MCL-TADF materials can be manipulated by minutely controlling their ICT excited states while minimizing the ACQ effect through rational material design.

Herein, we present a versatile design strategy for highefficiency MCL-TADF materials featuring stimuli-responsive twisted ICT excited states. A novel mechanism for

mechanochromic TADF switching in carbazole–isophthalonitrilebased luminogens **1–3** (Figure 1a) is reported. Thus far, some TADF materials have been reported to exhibit distinct MCL color changes in response to external forces.^[11–17] The key design strategy adopted in most of these previous reports was the use of structurally deformable D units such as phenothiazine, which played a vital role in their MCL responsivity via the quasi-axial and quasi-equatorial conformational changes.^[11–16] In contrast, our present MCL-TADF systems rely on the stimuli-triggered alteration of intramolecular D–A twisting (or torsion angles) in their ICT excited states and do not entail significant changes in noncovalent intermolecular interactions, resulting in notably high Φ_{PL} values (75%–98%) even after the MCL color changes in the condensed states.

Results and Discussion

Compounds **1–3** were prepared via nucleophilic aromatic substitution reactions using fluorinated isophthalonitrile precursors and 3,6-di-*tert*-butylcarbazole.^[8a,18] The peripheral *tert*-butyl ([']Bu) groups were introduced to suppress the intermolecular interactions and exciton deactivation arising from collisional Dexter energy transfer,^[19] thereby boosting Φ_{PL} in the solid states. Detailed synthetic procedures and characterization data are described in the Supporting Information. While the synthesis and basic TADF characteristics for **3** were previously reported by Lee et al.,^[18] its MCL-TADF properties have not been revealed thus far. More recently, a polymorphic behavior of **3** arising from dimer formation was also reported by Etherington et al.^[20]



Figure 1. a) Molecular structures of propeller-shaped MCL-TADF luminogens **1–3**. Single-crystal X-ray structures of b) **1** and c) **3** (CCDC 1990823 and 1990824, respectively) with thermal ellipsoids at 50% probability. Hydrogen atoms and disordered 'Bu groups are omitted for clarity.

X-ray crystallographic analyses for **1** and **3** provided indepth insight into their stable molecular structures and the relative arrangement of the carbazolyl (Cz) units in the ground state (Figure 1b,c). The planar Cz units in both molecules adopted a highly twisted arrangement but not orthogonal with respect to the central isophthalonitrile core, as evidenced by the large dihedral angles of 56–79°. These propeller-shaped D–A arrangements can ensure effective spatial separation of the frontier molecular orbitals, leading to distinct ICT excited states and small $\Delta E_{\rm ST}$.

Intriguingly, all 1-3 solid samples showed distinct MCL behavior in response to external stimuli, such as grinding. As presented in Figure 2, the pristine powders of 1 and 2 obtained by recrystallization from chloroform/methanol exhibited intense blue PL emissions peaking at λ_{PL} = 470 and 466 nm, with Φ_{PL} as high as 98% and 82%, respectively. When these samples were subjected to mechanical grinding with mortar and pestle, the λ_{PL} positions were found to redshift to 515 and 512 nm, respectively, displaying similar intense green PL emissions. It is worth noting that ground **1** and **2** still retained considerably high Φ_{Pl} values of 80% and 75%, respectively, indicating that ACQ could be well suppressed as opposed to conventional fluorescent MCL materials. For 3 with four Cz units, the emission color changed clearly from green (λ_{PL} = 525 nm; Φ_{PL} = 92%) to yellow (λ_{PL} = 557 nm; Φ_{PL} = 80%) upon mechanical grinding. The original emission colors of 1-3 could be recovered by recrystallization or exposure to tetrahydrofuran (THF) or chloroform vapor, confirming the reversibility of their mechano/vapochromic processes.



Figure 2. a–c) Steady-state PL spectra and d–f) transient PL decay profiles for the pristine and ground powders of **1–3** measured at room temperature. Insets: photographs showing MCL color changes observed for **1–3** in response to mechanical grinding under UV irradiation at 365 nm.

Compound	State	λ _{ΡL} ^[a] [nm]	$arPel^{[b]}$	$arPhi_{ m p}^{[m c]}$	$arPsi_{d}^{[c]}$	$ au_{p}^{[d]}$ [ns]	τ _d ^[d] [μs]	<i>k</i> _r ^[e] [S ⁻¹]	k _{isc[f]} [s⁻1]	k _{RISC} [g] [S⁻1]	Es ^[h] [eV]	<i>E</i> _T ^[h] [eV]	∆E _{ST} ^[i] [eV]
1	Sol ^[j]	500	49	2	47	14	11	6.5 × 10 ⁶	7.6 × 10 ⁷	6.8 × 10 ⁵	-	-	-
	Pristine	470	98	2	96	7.3	20	1.5 × 10 ⁶	1.4 × 10 ⁸	4.5×10^{6}	2.85	2.82	0.03
	Ground	515	80	23	57	16	6.8	1.5 × 10 ⁷	4.9×10^{7}	4.7 × 10 ⁵	2.72	2.68	0.04
	Film ^[k]	514	98	32	66	17	5.4	2.7 × 10 ⁷	5.6×10^{7}	5.5 × 10 ⁵	2.73	2.69	0.04
2	Sol ^{ij]}	485	42	2	40	14	37	8.9 × 10 ⁶	7.0 × 10 ⁷	4.7 × 10 ⁵	-	-	-
	Pristine	466	82	2	80	6.0	22	3.0×10^{6}	1.6 × 10 ⁸	1.6 × 10 ⁶	2.90	2.83	0.07
	Ground	512	75	33	42	18	10	1.8 × 10 ⁷	3.7 × 10 ⁷	2.5 × 10 ⁵	2.74	2.69	0.05
	Film ^[k]	507	89	35	54	17	9.8	1.5 × 10 ⁷	5.0×10^{7}	3.6 × 10 ⁵	2.75	2.70	0.05
3	Sol ^{ij]}	528	93	17	76	15	3.0	1.1 × 10 ⁷	5.5 × 10 ⁷	1.8 × 10 ⁶	-	-	-
	Pristine	525	92	6	86	7.8	2.6	7.6×10^{6}	1.1 × 10 ⁸	5.2 × 10 ⁶	2.57	2.49	0.08
	Ground	557	80	29	51	16	2.1	1.8 × 10 ⁷	4.3×10^{7}	1.2 × 10 ⁶	2.48	2.44	0.04
	Film ^[k]	557	74	30	44	16	1.8	2.2 × 10 ⁷	4.0 × 10 ⁷	1.2 × 10 ⁶	2.50	2.47	0.03

Table 1. Photophysical data of MCL-TADF luminogens 1-3 in different states

[a] PL emission maximum. [b] Absolute PL quantum yield evaluated using an integrating sphere under N₂. [c] Fractional quantum yields for prompt fluorescence (Φ_p) and delayed fluorescence (Φ_b); $\Phi_p + \Phi_d = \Phi_{PL}$. [d] Emission lifetimes for prompt fluorescence (τ_p) and delayed fluorescence (τ_d). [e] Rate constant of fluorescence radiative decay (S₁ \rightarrow S₀): $k_r = \Phi_p/\tau_p$. [f] Rate constant of ISC (S₁ \rightarrow T₁): $k_{\text{ISC}} = (1 - \Phi_p)/\tau_p$. [g] Rate constant of RISC (T₁ \rightarrow S₁): $k_{\text{RISC}} = \Phi_d/(k_{\text{ISC}} \cdot \tau_p \cdot \tau_d \cdot \Phi_p)$. [h] Lowest excited singlet (E_s) and triplet (E_T) energies estimated from the onsets of the fluorescence and phosphorescence spectra. [i] Singlet–triplet energy splitting: $\Delta E_{\text{ST}} = E_s - E_T$. [j] Measured in deoxygenated toluene solution (10⁻⁵ M). [k] Measured as a vacuum-deposited neat film.

Time-resolved PL measurements revealed that both the pristine and ground powders of 1-3 exhibited noticeable twocomponent transient PL decay composed of a nanosecond prompt fluorescence and a microsecond delayed fluorescence (Figure 2d-f). These are typical characteristics of TADF involving spin-converting intersystem crossing (ISC; $S_1 \rightarrow T_1$) and reverse intersystem crossing (RISC; $T_1 \rightarrow S_1$) processes.^[8,9] The prompt fluorescence lifetimes (T_p) for the ground samples of 1-3 were measured to be 15-20 ns, which were longer than those for the pristine ones ($\tau_{\rm p}$ = 6.0–7.8 ns). Conversely, the corresponding delayed fluorescence lifetimes (τ_d) appeared to have shortened upon grinding. The detailed MCL-TADF and relevant photophysical data are summarized in Table 1. These peculiar stimuli-triggered photophysical switching in terms of TADF colors and lifetimes can be mainly attributed to the variations in the ICT-based S_1 and T_1 excited energies (E_S and $E_{\rm T}$) in the solid states before and after applying the mechanical forces, as will be discussed later.



Figure **3**. a) Powder XRD patterns of **1** in the form of pristine powder (blue line) and ground powder (green line). The simulated result based on the crystallographic data (black line) is also included. b) DSC thermograms of a pristine sample of **1** upon first heating and a ground sample of **1** in a heating and cooling cycle at a scanning rate of 10 °C min⁻¹ under N₂.

Powder X-ray diffraction (XRD) analysis provided useful insight into the stimuli-triggered morphological changes in 1-3. As shown in Figure 3a (see also Supporting Information), the XRD patterns of the pristine samples of 1-3 showed sharp diffraction peaks and aligned with the simulated patterns based on the crystallographic data, implying that these initial materials are essentially microcrystalline solids. After mechanical grinding, the pronounced diffraction peaks disappeared, suggesting that each sample transformed into an amorphous state. Hence, the MCL-TADF behaviors in 1-3 can be envisaged to be accompanied by the crystalline-to-amorphous transformation within the solid states. The morphological changes could also be confirmed by differential scanning calorimetry (DSC). As can be seen from Figure 3b, the ground sample of 1 exhibited an exothermic peak at 158 °C with a small transition enthalpy (ΔH ~3 J g⁻¹) upon heating, which originated from the coldrecrystallization of the mechano-amorphized powder, whereas its pristine unground sample showed neither an exothermic nor an endothermic peak until 250 °C before thermal decomposition. This observation suggests that the ground amorphized state is metastable and tends to return to a thermodynamically stable crystalline state through molecular reorganization upon heating.

Now the question arises as to how the foregoing solid-state morphological changes in **1–3** can affect their MCL color changes. To clarify this and understand the underlying mechanism of the MCL-TADF phenomena, we computationally simulated the geometric structures in the ground (S₀) and excited S₁ and T₁ states, as well as the electronic transition characteristics for **1–3**, using density functional theory (DFT) and time-dependent DFT (TDDFT) methods. As depicted in Figure 4, the dihedral angles between the 2-Cz unit and the central isophthalonitrile unit (θ_2) were calculated to be ~66° for **1** and **2** in the optimized S₀ geometries.^[21] Importantly, in their S₁ and T₁ states, θ_2 substantially increased to 82–90° to form full-twisted

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Figure 4. Optimized molecular geometries of 1–3 at S_0 , S_1 , and T_1 states (left) and hole and electron distributions of the natural transition orbitals (NTOs) and the adiabatic excitation energies for the S_1 and T_1 states of 1–3 (center, right), calculated at the PBE0/6-31G(d) level in gas phase. HLCT = hybrid local and charge-transfer excited state.

ICT excited states with orthogonal D-A arrangements. Note that for 2, there is no significant contribution from the opposite 5-Cz unit to the hole density distribution in its S_1 and T_1 states, resulting in electronic transition characteristics analogous to 1. Consequently, the hole and electron densities are localized on the 2-Cz and diphenyl-isophthalonitrile moieties, respectively, in the optimized excited S_1 and T_1 states, which can cause complete charge separation and lower (or stabilize) the resulting ICT energy levels. However, 3 with additional Cz units had different geometric and electronic features in comparison with 1 and 2. While θ_2 in 3 underwent almost no change upon electronic excitation, the calculated dihedral angles between the 4,5,6-Cz units and the isophthalonitrile unit (θ_4 , θ_5 , and θ_6) were found to increase significantly. In this case, the 4,5,6-Cz units serve as the actual D units, and hence, the hole density in the S_1 state is solely distributed on the 4,5,6-Cz units instead of the 2-Cz unit.[22] Based on these electronic configurations, all 1-3 were calculated to have sufficiently small adiabatic ΔE_{ST} values in the range of 18-52 meV (Figure 4) to induce TADF. These TDDFT results unambiguously indicate that the ICT excitation/emission processes of 1-3 should be accompanied by large variations of intramolecular D-A twisting due to the Cz rotation. In the crystalline states, such structural relaxation would be strongly suppressed by constraints from the dense and rigid molecular packings that make the D and A units remain the initial relatively less twisted arrangements even in the excited state, as can be observed in the X-ray structures (Figure 1b,c). Therefore, the pristine microcrystalline powders of 1-3 led to higher-energy (or blue-shifted) TADF emissions. In contrast, because the disordered amorphous states are generally less

dense and possess a relatively large free volume, the specific Cz units in **1–3** can more freely rotate to afford the orthogonal excited D–A structures with a more stabilized ICT excited state, as predicted by the TDDFT calculations (Figure 4). Consequently, the PL spectra underwent conspicuous red-shifts along with TADF color changes via the crystalline-to-amorphous transformation.

As expected, for the vacuum-deposited neat films, the TADF properties of 1-3 closely resembled those of the ground amorphous powders (Table 1). Their ϕ_{PL} values were as high as 98%, 89%, and 74%, individually, which renders them practically useful for device fabrication. То investigate the electroluminescence (EL) performances of 1-3, nondoped OLEDs were fabricated using the vacuum deposition method, with the configuration of indium tin oxide (ITO)/2,3,6,7,10,11hexacyano-1,4,5,8,9,12-hexaazatriphenylene (HAT-CN, 10 nm)/1,1-bis[4-[N,N-di(p-tolyl)amino]phenyl]cyclohexane (TAPC, 50 nm)/9-phenyl-3,9'-bicarbazole (CCP, 10 nm)/1,3-bis(Ncarbazolyl)benzene (mCP, 10 nm)/1-3 (20 nm)/ 2,8bis(diphenylphosphoryl)dibenzo[b,d]furan (PPF, 10 nm)/1,3bis[3,5-di(pyridin-3-yl)phenyl]benzene (B3PyPB, 40 nm)/8hydroxyquinoline lithium (Liq, 1 nm)/Al (100 nm). $^{\left[23\right]}$ The EL density-voltage-luminance spectra. current (J-V-L)characteristics, and external EL quantum efficiency (η_{ext}) versus J plots for this set of devices are depicted in Figure 5, and the key EL parameters are listed in Table 2.

Similar to the PL spectra of the thin films and ground powders, devices A–C employing **1–3** as a neat emission layer (EML) displayed green to yellow structure-less EL with peaks (λ_{EL}) at 509, 512, and 546 nm, respectively. Although **1** had the

highest ϕ_{PL} in the neat film, the EL performance of device A was limited due to a rather high turn-on voltage ($V_{on} \sim 7$ V), probably due to its relatively low hole injection and hole/electron transport properties. As revealed by photoelectron yield spectroscopy (Supporting Information), the ionization potential of 1 (IP = 6.0 eV) was indeed higher than those of 2 and 3 with multiple Cz units (IP = 5.7 and 5.5 eV, respectively). As a result, device A showed a relatively low external EL quantum efficiency (η_{ext}) of less than 10% due to poor charge balance. However, with a very low Von of 3.2 V, device B based on analogous 2 demonstrated the best EL performance with a maximum η_{int} of 18.2%, current efficiency (CE) of 54.8 cd $A^{-1},$ and power efficiency (PE) of 47.4 Im W⁻¹. The maximum η_{ext} values were in the order of device B (18.2%) > device C (13.5%) > device A (9.6%). Moreover, small efficiency roll-offs were attained in devices B and C. In particular, the η_{ext} of device B was maintained as high as 16.2% even at a high luminance of 1000 cd m⁻¹, corresponding to ~11% roll-off relative to the maximum η_{ext} value. Note also that in comparison with these nondoped devices, the doped OLEDs using 1-3 with a high-T₁ PPF host showed excellent EL performances with a maximum η_{ext} of 17.4%–21.1% (Supporting Information).



Figure 5. EL characteristics of nondoped OLEDs (devices A–C) based on **1–3** as MCL-TADF emitters: a) EL spectra at 10 mA cm⁻¹, b) photographs of EL emissions, c) *J*–*V*–*L* characteristics, and d) η_{ext} versus *J* plots.

Table 2. Performances of nondoped OLEDs based on 1-3 as emitters

	Device A (1)	Device B (2)	Device C (3)
V _{on} ^[a] [V]	7.0	3.2	3.2
$\lambda_{EL^{[b]}}$ [nm]	509	512	546
$CIE^{[c]}(x, y)$	(0.25, 0.51)	(0.25, 0.53)	(0.40, 0.57)
L _{max^[d] [cd m⁻²]}	4400	13000	17300
η _{ext,max} ^[e] [%]	9.6	18.2	13.5
η _{ext,100/1000} ^[f] [%]	9.6/8.0	18.2/16.2	13.5/12.7
CE ^[g] [cd A ⁻¹]	28.2	54.8	45.5
PE ^[h] [Im W ⁻¹]	11.7	47.4	41.5

[a] Turn-on voltage at a luminance above 1 cd m⁻². [b] EL emission maximum at 10 mA cm⁻¹. [c] Commission Internationale de l'Éclairage (CIE) color coordinates recorded at 10 mA cm⁻². [d] Maximum luminance. [e] Maximum external EL quantum efficiency. [f] External EL quantum efficiency at luminance of 100 and 1000 cd m⁻². [g] Maximum current efficiency. [h] Maximum power efficiency.

Motivated by the efficient color-switchable TADF properties, we attempted to produce bicolor emissive OLEDs using both the amorphous and crystalline states of 1 as an EML. To this end, nondoped solution-processed OLEDs were fabricated with a configuration of ITO/poly(3,4ethylenedioxythiophene):poly(styrenesulfonate):tetrafluoroethyle neperfluoro-3,6-dioxa-4-methyl-7-octenesulfonic acid copolymer (PEDOT:PSS:PFI, 30 nm)/poly(N-vinylcarbazole) (PVK, 20 nm)/amorphous or crystalline 1 (20 nm)/PPF (10 nm)/1,3,5tris(N-phenylbenzimidazol-2-yl)benzene (TPBi, 40 nm)/Liq (1 nm)/AI (100 nm).^[6] In the device fabrication (Figure 6a), the neat film of 1 was initially spin-coated onto the ITO/PEDOT:PSS:PFIcoated substrates to obtain an amorphous green-emissive EML. To convert it to a blue-emissive EML, the obtained 1-coated substrate was then exposed to THF (or chloroform) vapor. Subsequently, the electron-transporting PPF and TPBi layers, as well as the Lig/Al cathode, were vacuum deposited on each asspun amorphous layer and vapor-fumed microcrystalline layer of 1, affording devices D and E, respectively. Significantly, green and blue bicolor EL emissions with $\lambda_{\rm EL}$ of 509 and 492 nm were attained using a single emitter (Figure 6b,c). However, devices D and E showed lower maximum η_{ext} values (3.0% and 1.5%, respectively) than that of device A. The EL spectrum of device E was slightly red-shifted compared to the corresponding PL spectrum of microcrystalline 1 (Figure 2a), which can be ascribed to incomplete amorphous-to-crystalline transformation in the thin EML with a large surface area, unlike bulk powdery sample. Although some MCL and MCL-TADF materials have recently been applied as emitters in OLEDs, [6,12a,14,16,17,24] most of these devices showed mere monochromatic EL. Furthermore, to date, there have been few reports on bicolor emissive OLEDs based on a single emitter.^[6,24] We therefore believe that highefficiency multi-color OLEDs based on a single emitter can be realized in the future by further sophisticating the design of mechano/vapochromic TADF luminogens, as well as the device fabrication processes.





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via THF vapor annealing. b) EL spectra and c) η_{ext} versus J plots for devices D and E (inset: photographs of bicolor EL emissions from 1).

Conclusion

We have presented a universal design for high-efficiency MCL-TADF luminogens based on renowned carbazoleisophthalonitrile D-A systems and revealed the mechanism for their MCL behaviors from the molecular level to the condensed states. The resulting functional materials cannot only switch their TADF colors and emission lifetimes in response to external stimuli but can also retain high Φ_{PL} values (75%–98%) by minimizing the ACQ effect in the solids. It was found that a tiny alteration of the intramolecular D-A twisting in the ICT excited states causes drastic changes in the TADF and photophysical properties. Additionally, we have successfully demonstrated high-performance nondoped OLEDs with a high η_{int} and small efficiency roll-off, as well as two-color emissive OLEDs, using a single TADF emitter. Thus, this work provides a new guideline for designing advanced MCL-TADF materials with tunable photophysical properties.

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Conflict of interest

The authors declare no conflict of interest

Keywords: mechanochromism • thermally activated delayed fluorescence • charge transfer • organic light-emitting diodes • solid-state luminescence

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A mechanism of delayed fluorescence switching for propeller-shaped twisted donor-acceptor systems driven by mechanical force is reported. By applying this concept, blue and green bicolor emissive light-emitting devices can be produced using a single emitter endowed with stimuli-responsive luminescence and delayed fluorescence properties.