displays excellent performances. Indeed, a high EQE of 17.6% with CE of 37.8 cd/A and PE of 37.1 lm/W were recorded at 0.04 mA/cm² (average values, Table 2). At 10 mA/cm², the performance remains high, 12.6% (CE = 27.0 cd/A and PE = 14.6 lm/W), showing the stability of the host under device working conditions. It is important to mention that at the high luminance of 5000 cd/m^2, the device still displays a high EQE of 12.3% and at 10000 cd/m^2 the EQE is still recorded at 10.9 % (see SI).

For both devices, the threshold voltage (V_{on}) is very low, 2.3 V for the green PhOLED and 2.5 V for the blue PhOLED, signing an efficient charge injection in the EML. This is due to the good matching between the HOMO level of **SPA-F(POPh$_2$)$_2$** (-5.40 eV) and ITO/PEDOT-PSS (-5.1 eV), which facilitates the hole injection.

All the devices exhibited identical green or blue emission arising from their corresponding Iridium complex, showing an efficient energy transfer cascade (see electroluminescent spectra in SI). To conclude, it should be precise that versatile hosts, which can be efficiently used in both green and blue SL-PhOLEDs are very rarely reported in literature. For example, in 2017, Zhao, Xie and their coworkers have reported a versatile host material for SL-PhOLEDs constructed on the judicious association of benzimidazole and carbazole units. If the performance of green SL-PhOLEDs were reported to be high (EQE of 14.6%), those of blue devices only reached ca 10%.[19]

	Von (V)	EQE (%)	CE (cd/A)	PE (lm/W)	EQE (%)	CE (cd/A)	PE (lm/W)	Luminance (cd/m^2)
Green PhOLEDs (10% Ir(ppy)$_3$)								
		At 10 mA/cm^2			Max (at J (mA/cm^2))			At J (mA/cm^2)
SPA-F(POPh$_2$)$_2$	2.3	10.9	37.1	17.7	15.6 (0.04)	52.9 (0.04)	52.0 (0.04)	38970 (180)
SBF(POPh$_2$)$_2$	2.8	4.6	12.1	5.3	5.2 (50)	14.3 (50)	5.0 (50)	11620 (120)
SPA-F	5.9	0.1	0.3	0.1	0.2 (25)	0.4 (24)	0.1 (21)	96 (90)
Blue PhOLEDs (10% FIrpic)								
SPA-F(POPh$_2$)$_2$	2.5	12.6	27.0	14.6	17.6 (0.04)	37.8 (0.04)	37.1 (0.04)	11400 (50)
SBF(POPh$_2$)$_2$	4.1	0.35	0.42	0.16	0.6 (44)	0.7 (36)	0.2 (22)	152.9 (50)
SPA-F	Performance not recordable							

Table 2. Average performance of SL-PhOLEDs using **SPA-F(POPh$_2$)$_2$, SBF(POPh$_2$)$_2$** or **SPA-F** as host material and 10% Ir(ppy)$_3$ or FIrpic as green or blue emitter respectively. Device structure: ITO/PEDOT:PSS (40 nm)/host + dopant (100 nm)/LiF (1.2 nm)/Al (100 nm).

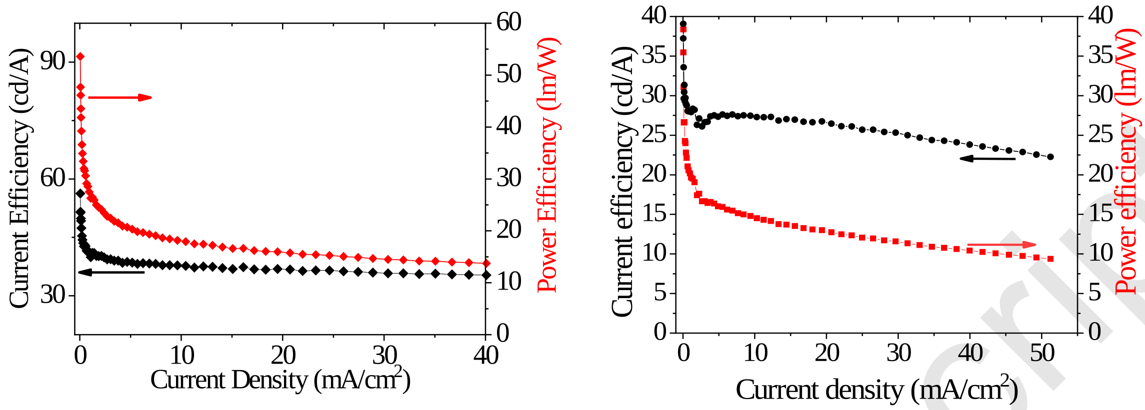

Figure 5: Current (cd/A) and power (lm/W) efficiency vs current density (mA/cm^2) for the best green (Left) and blue (Right) SL-PhOLEDs using **SPA-F(POPh$_2$)$_2$** as host

In order to shed light on the efficiency of the present bipolar host, we have investigated benchmark devices using the two model compounds **SPA-F** and **SBF(POPh$_2$)$_2$** as host (Table 2 and SI). First, SL-PhOLEDs using **SPA-F** as host display very low performance with an EQE below 0.5% for green PhOLEDs. Thus, from a chemical design point of view, the acridine is not directly responsible of the high performance of **SPA-F(POPh$_2$)$_2$**-based PhOLED.

Despite significant better performance than that of **SPA-F**, green SL-PhOLEDs using **SBF(POPh$_2$)$_2$** as host displays modest performance with a maximum EQE of 5.2 % (corresponding CE of 14.3 cd/A and PE of 5.0 lm/W, table 2), more than three times lower than that of **SPA-F(POPh$_2$)$_2$**.

For the blue SL-PhOLEDs, the efficiency of the model compounds is worst. Indeed, the performance of blue SL-PhOLEDs using **SPA-F** as host is too low to be measured and that using **SBF(POPh$_2$)$_2$** also displays very bad performances with an EQE <1%. Due to its deep HOMO level (-6.0 eV), SL-PhOLED using **SBF(POPh$_2$)$_2$** displays a high V_{on} of 4.1 V.

Thus, one can note that the two model compounds display very low performances when incorporated as host in blue SL-PhOLED whereas their combination in **SPA-F(POPh$_2$)$_2$** leads to high performance PhOLEDs. The performances difference observed in model compounds compared with that of **SPA-F(POPh$_2$)$_2$** is probably due to the energy levels adjustment, made from the association of the two molecular fragments, phenylacridine and 2,7-bis(diphenylphosphineoxide)-fluorene. Indeed, as observed in cyclic voltammetry, **SPA-F(POPh$_2$)$_2$** roughly exhibits the HOMO and LUMO energy levels of **SPA-F** and **SBF(POPh$_2$)$_2$**, respectively. In return, as shown in Table 1, the two model compounds, that could be, electronically speaking, considered as an incomplete half of the **SPA-F(POPh$_2$)$_2$** molecule, display either a HOMO or a LUMO level that does probably not allow efficient charge carrier injections in the device architecture used in this work. Thus, if considering the PEDOT-PSS work function to be around -4.9/5.2 eV,[49, 50] it seems pretty obvious that hole injection in the **SBF(POPh$_2$)$_2$** electron model compound will encounter a high barrier injection of at least 0.7-0.8 eV (HOMO = -6.0 eV). The same holds true regarding the electron injection in the **SPA-F** hole model compound that shows a significantly lower electron affinity (LUMO= -1.94 eV) than the diphenylphosphineoxide-functionalized molecules, **SPA-F(POPh$_2$)$_2$** and **SBF(POPh$_2$)$_2$**.

Conclusion

In this work, we have designed and synthesized, via an efficient approach, a high efficiency host material for green and more importantly for blue Single-Layer PhOLEDs. This host is using a chemical architecture based on the conjugation disruption, thanks to the spiro-connection, between the electron-rich phenylacridine moiety and the fluorene bearing the two phosphine oxide electron-deficient units. By comparing this new molecular host with the two model compounds constituted of each unit, we highlight that its optoelectronic properties correspond to a rational combination of the properties of the two model compounds. Thus, in addition to a high E_T (2.76 eV) and adequate HOMO/LUMO energy levels (-5.40 eV/-2.46 eV), the key point in the design of this host is its good balance between suitable hole and electron mobilities, which leads to a high-performance blue SL-PhOLED with an EQE of 17.6% (CE= 37.8 cd/A and PE = 37.1 lm/W) and a low V_{on} of 2.5 V. This high performance is among the highest reported to date and shows that the molecular design of the present host fulfils the criteria required for high efficiency SL-PhOLED. The green SL-PhOLED is also among the most efficient reported to date. As simplifying the device structure can be a central feature in the future of OLEDs, designing highly efficient semi-conductors for this purpose is an important step.

Supporting Information

Supporting Information is available from the Wiley Online Library or from the author.

Acknowledgments

The authors would like to thank the CINES (Montpellier N° 2018-A0040805032) for computing time, the ANR (n°14-CE05-0024) and the Region Bretagne (DIADEM project) for PhD grants (LJS and FL) and post-doctoral position (CQ), the CDFIX and CRMPO (Rennes). We would like to highly thank Dr Eric Le Fur (Rennes) for TGA analyses, Dr Franck Camerel for his help in DSC measurements and Dr Emmanuel Jacques (Rennes) for fruitful discussions about charge carrier mobilities.

Received: ((will be filled in by the editorial staff))
Published online: ((will be filled in by the editorial staff))

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