

## Supplementary material

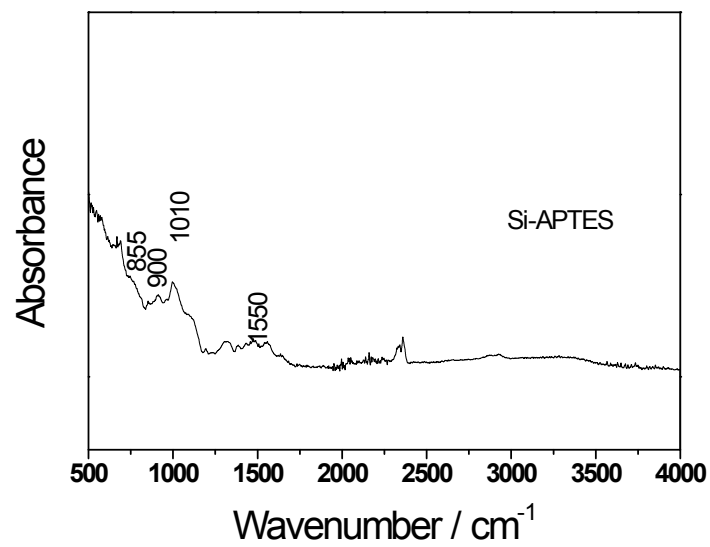
### Multi-component hybrid films based on covalent post-synthetic functionalization of silicon chip using both ZIF-90 and lanthanide complexes for luminescence tuning

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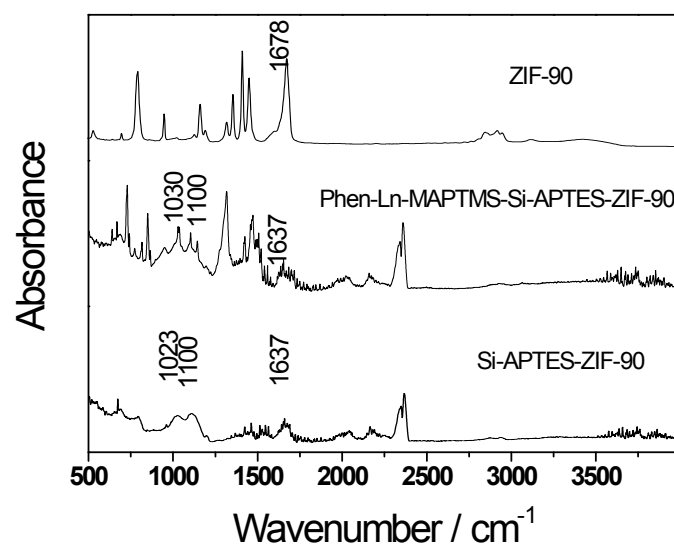
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**Table S1** The mass change of hybrid film after blown under different flow rate of oxygen

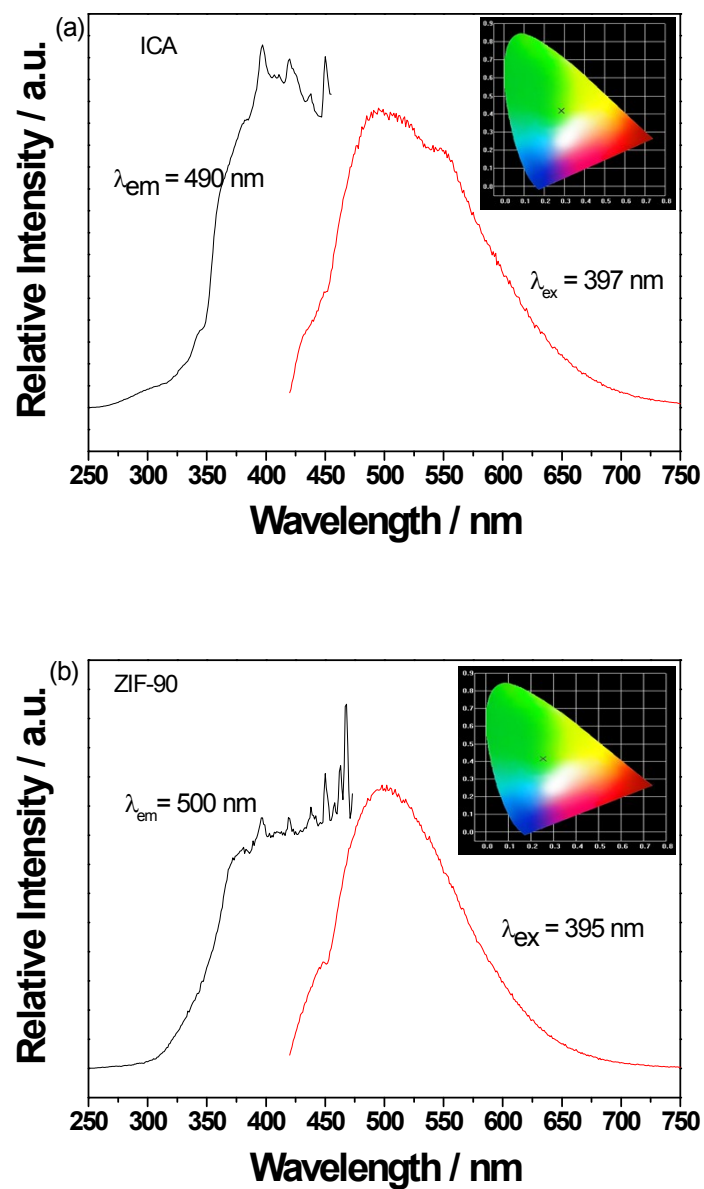
| Rate of flow (L/min)          | 15     |        | 20     |        | 25     |        |
|-------------------------------|--------|--------|--------|--------|--------|--------|
| Sample                        | (g)    |        |        |        |        |        |
| Phen-Eu-MPTMS-Si-APTES-ZIF-90 | 0.4347 | 0.4245 | 0.4345 | 0.4345 | 0.4347 | 0.4343 |
| Phen-Tb-MPTMS-Si-APTES-ZIF-90 | 0.4501 | 0.4549 | 0.4501 | 0.4549 | 0.4501 | 0.4548 |
| Phen-Sm-MPTMS-Si-APTES-ZIF-90 | 0.3908 | 0.3908 | 0.3908 | 0.3907 | 0.3908 | 0.3906 |
| Phen-Dy-MPTMS-Si-APTES-ZIF-90 | 0.4471 | 0.4470 | 0.4471 | 0.4469 | 0.4470 | 0.4469 |



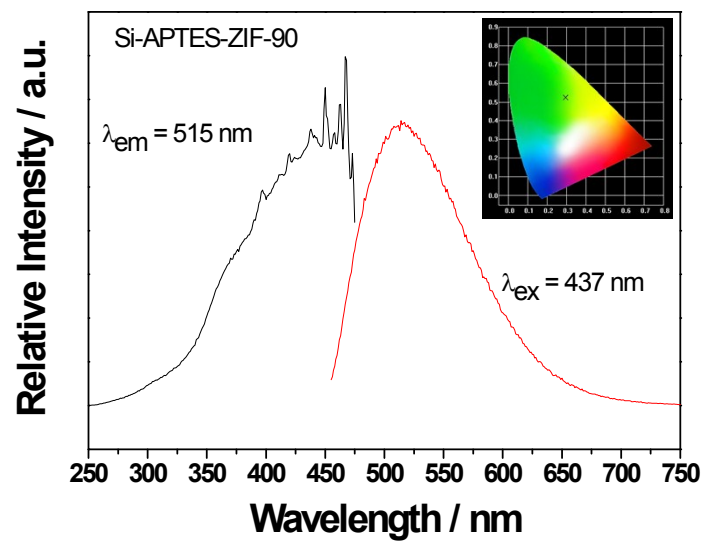
**Figure S1** FTIR spectra of Si-APTES



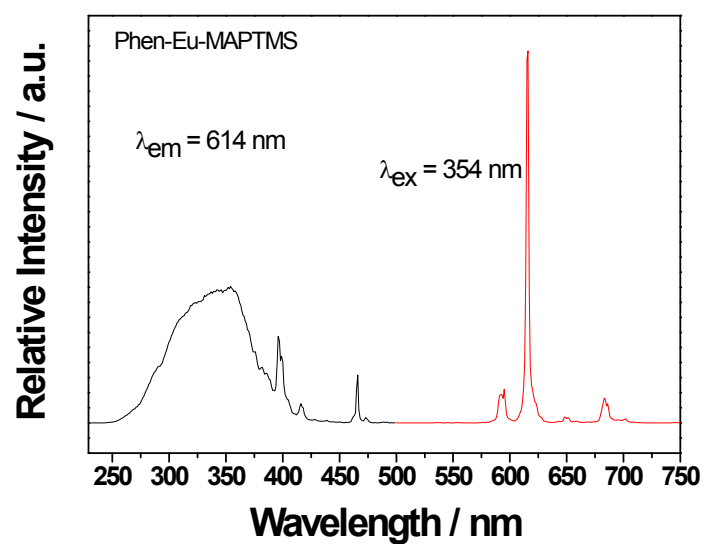
**Figure S2** FTIR spectra of ZIF-90, Phen-Ln-MAPTMS-Si-APTES-Si-APTES-ZIF-90 and Si-APTES



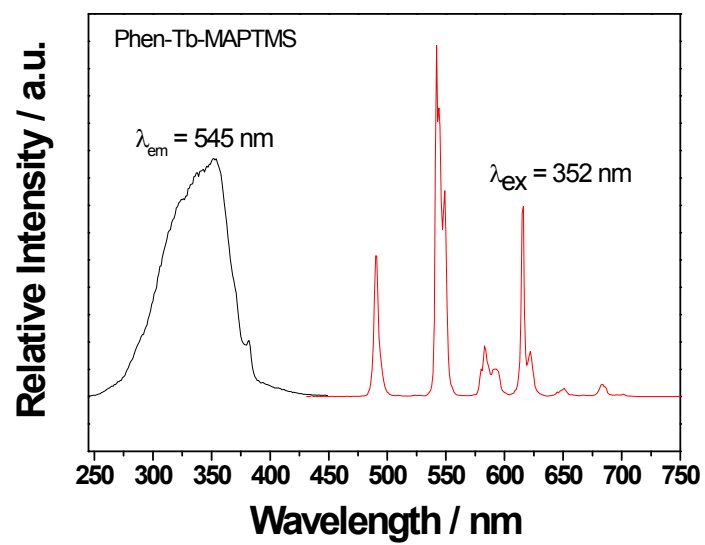
**Figure S3** (a) Excitation (black line) and emission (red line) spectra of imidazolate-2-carboxyaldehyde (ICA). (b) Excitation (black line) and emission (red line) spectra of ZIF-90. The inset is the corresponding CIE chromaticity diagram of ICA under the excitation of 397 nm (0.2884, 0.4184) and ZIF-90 under the excitation of 395 nm (0.2566, 0.4120).



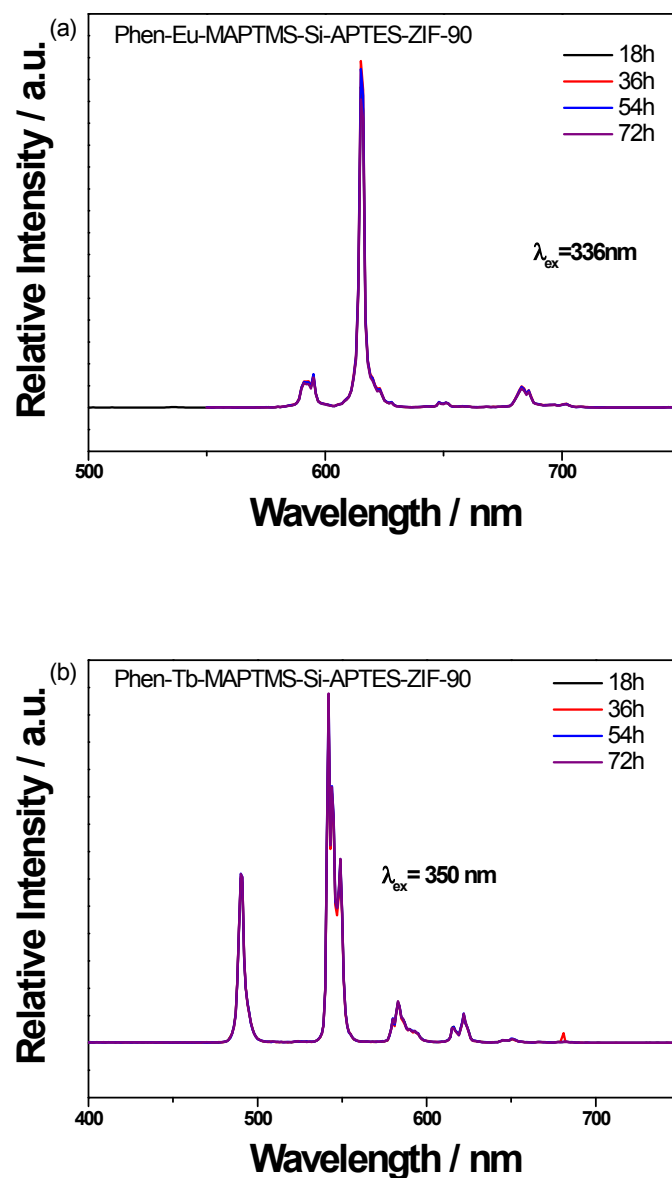
**Figure S4** Excitation (black line) and emission (red line) spectra of Si-APTES-ZIF-90. The inset is the corresponding CIE chromaticity diagram of Si-APTES-ZIF-90 under the excitation of 437 nm (0.2945, 0.5235).



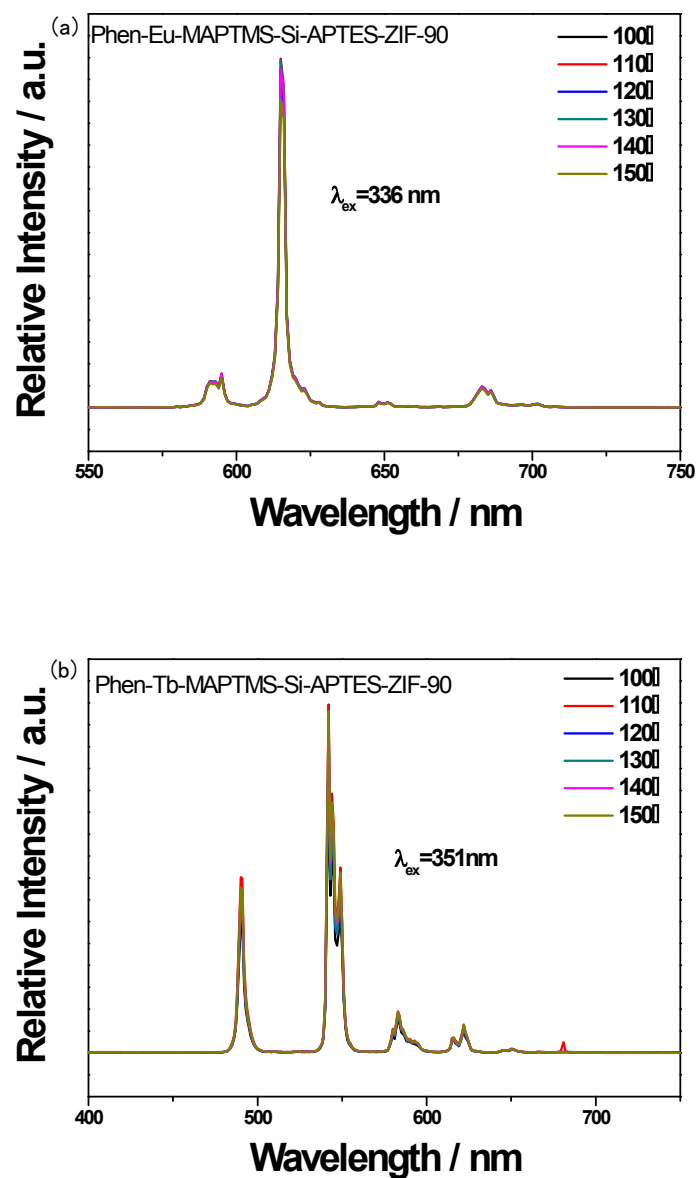
**Figure S5** Excitation (black line) and emission (red line) spectra of Phen-Eu-MAPTMS



**Figure S6** Excitation (black line) and emission (red line) spectra of Phen-Tb-MAPTMS



**Figure S7** (a) Under 336 nm the intensity change of luminescence spectra after 18h, 36h, 54h, 72h when Phen-Eu-MAPTMS-Si-APTES-Si-APTES-ZIF-90 film exposing to air that humidity is about 51%. (b) Under 350 nm the intensity change of luminescence spectra after 18h, 36h, 54h, 72h when Phen-Eu-MAPTMS-Si-APTES-Si-APTES-ZIF-90 film exposing to air that humidity is about 51%.



**Figure S8** (a) Under 336 nm the intensity change of luminescence spectra after Phen-Eu-MAPTMS-Si-APTES-ZIF-90 film is heated from 100 °C to 150 °C. (b) Under 351 nm the intensity change of luminescence spectra after Phen-Tb-MAPTMS-Si-APTES-90 film is heated from 100 °C to 150 °C.