

**Novel red-emitting phosphors $A_2HfF_6:Mn^{4+}$ ($A = Rb^+, Cs^+$)
for solid-state lighting**

Zhaofeng Yang,^a Qianwen Wei,^a Meizhu Rong,^b Zhiyu Yang,^a Zhengliang Wang,^{a*}

Qiang Zhou,^a and Qin Wang^{b*}

*^a Key Laboratory of Comprehensive Utilization of Mineral Resource in Ethnic
Regions, Joint Research Centre for International Cross-border Ethnic Regions
Biomass Clean Utilization in Yunnan, School of Chemistry & Environment, Yunnan
Minzu University, Kunming, Yunnan 650500, P. R. China.*

*^bCollege of Chemistry and Chemical Engineering, Yunnan Normal University,
Kunming, Yunnan 650500, P. R. China.*

* Corresponding author

E-mail: wangzhengliang@foxmail.com (Zhengliang Wang);

wangqinyinu@163.com(Qin Wang)

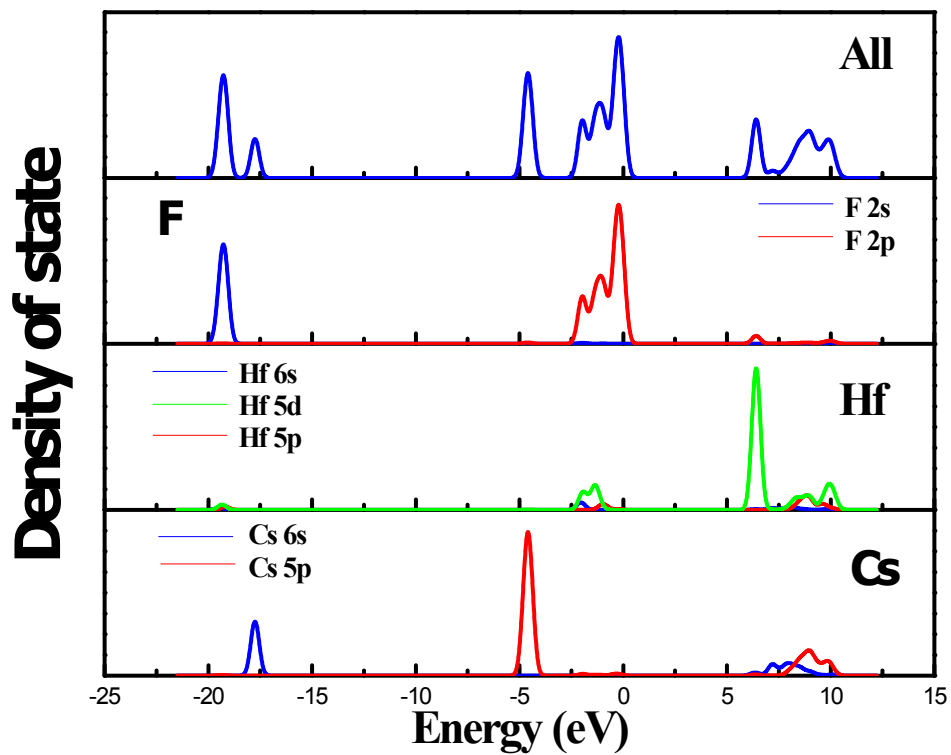
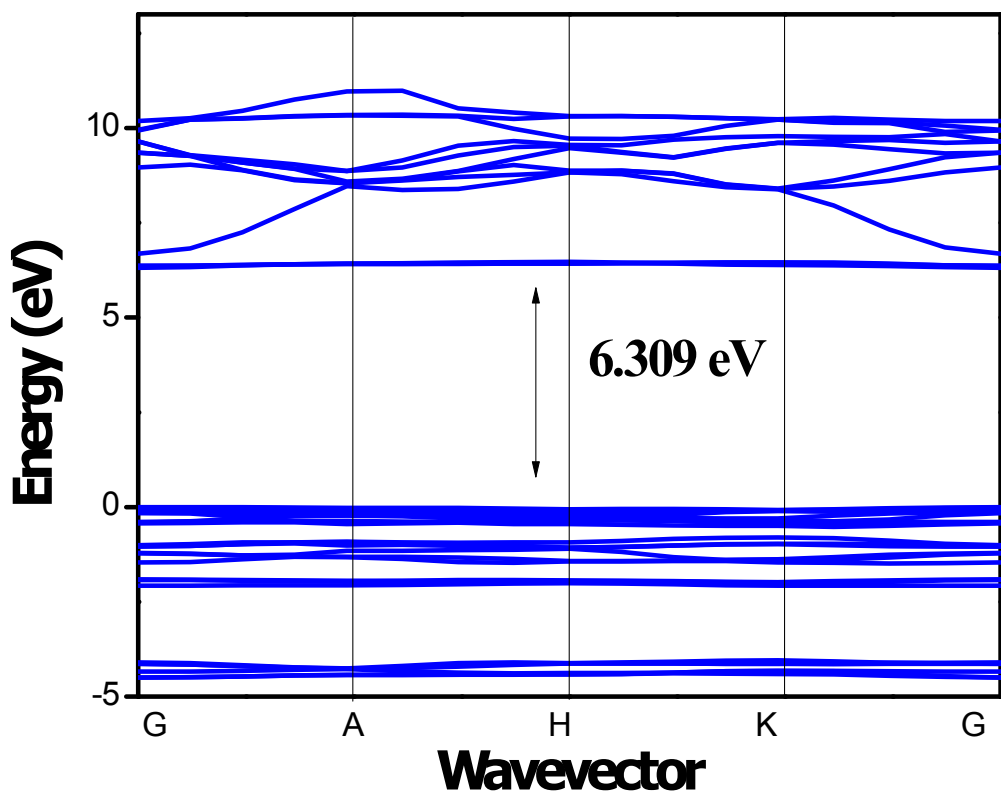


Fig. S1 (a) calculated energy band structure of Cs_2HfF_6 , (b) total and partial density of states for Cs_2HfF_6 .

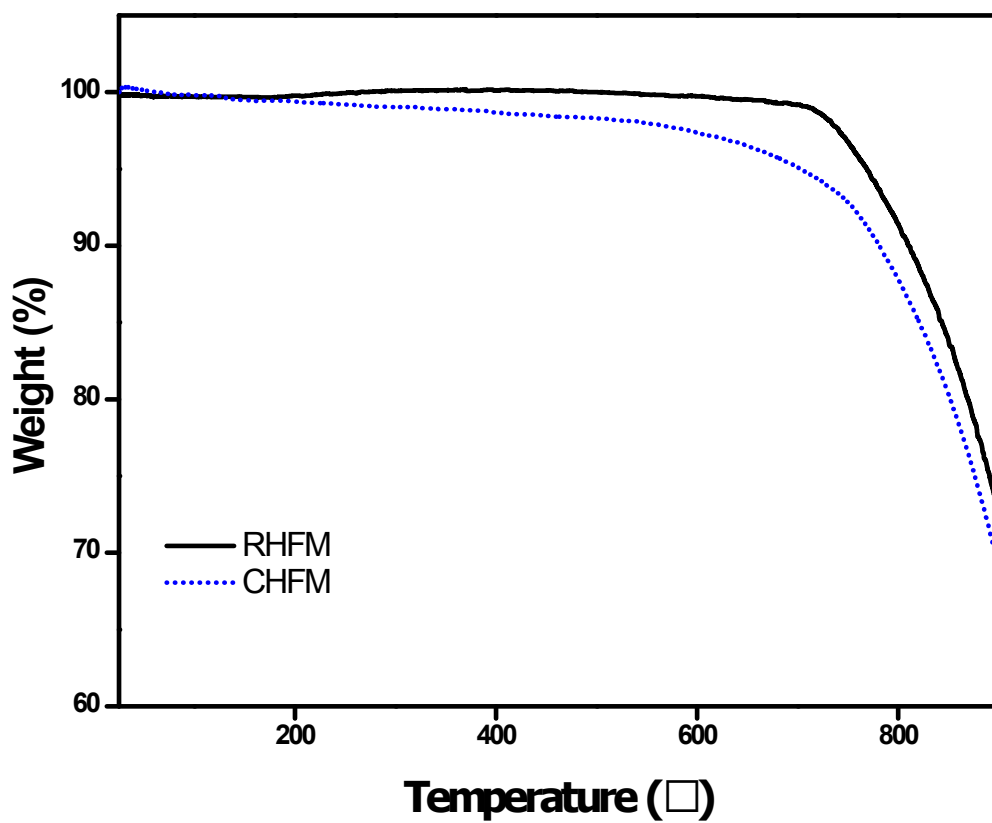


Fig.S2 TG curves of $A_2HfF_6:Mn^{4+}$ ($A = Rb^+, Cs^+$).

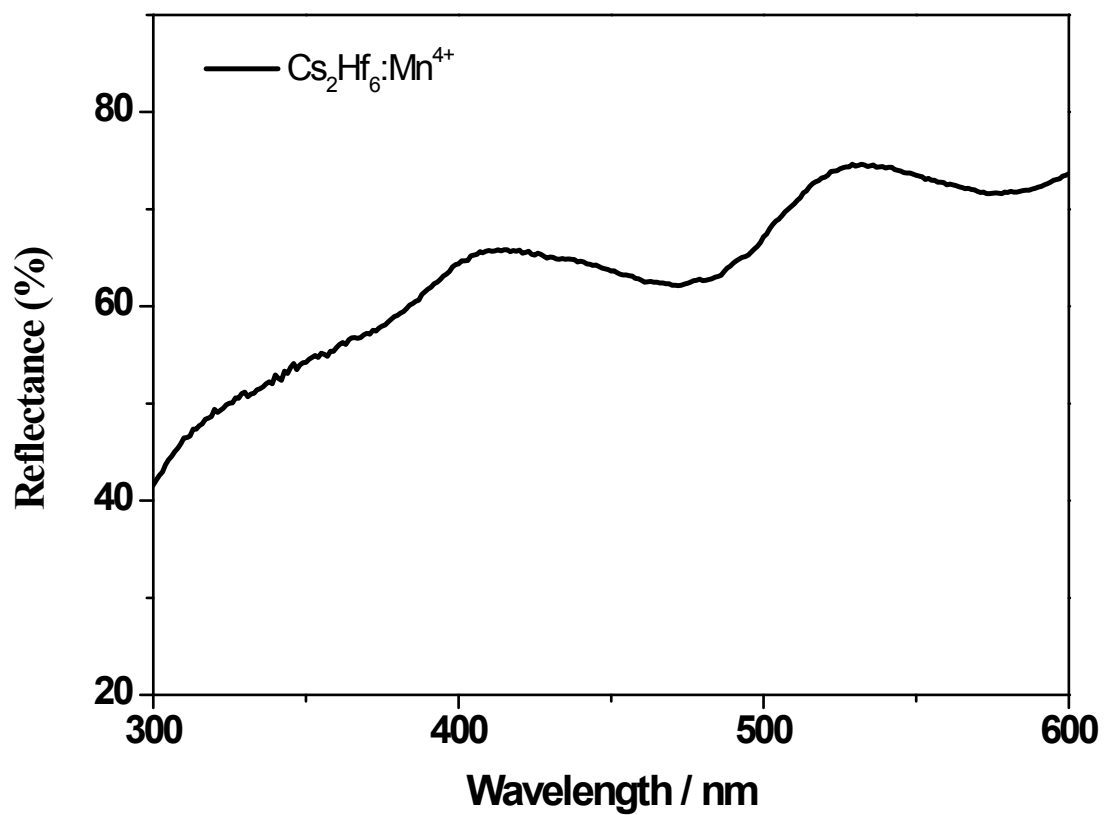


Fig. S3 Diffuse reflectance spectrum of $\text{Cs}_2\text{Hf}_6:\text{Mn}^{4+}$.

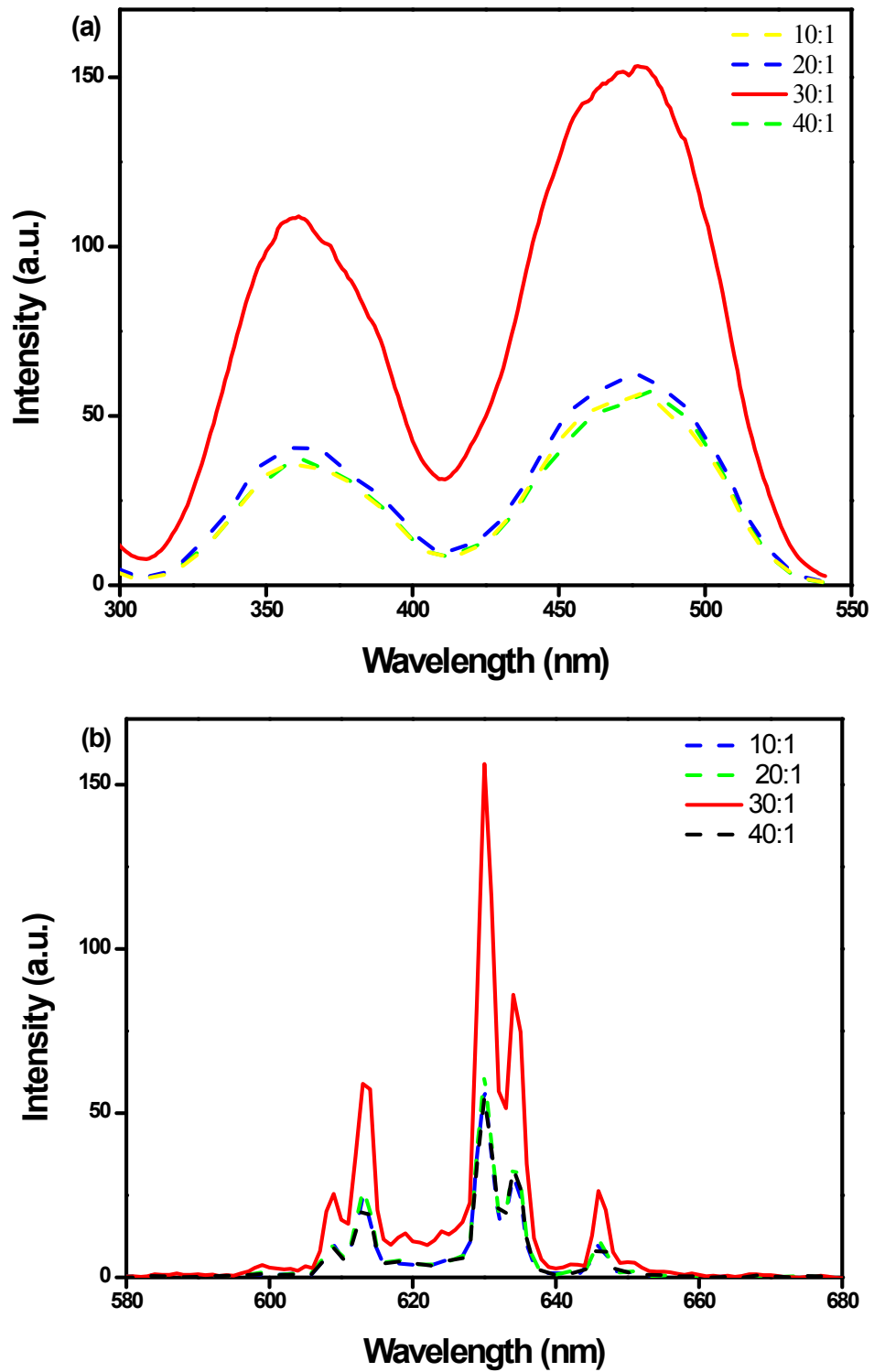


Fig.S4 (a) Excitation and (b) emission spectra of the $\text{Rb}_2\text{HfF}_6:\text{Mn}^{4+}$ samples with different molar ratios of HfO_2 to K_2MnF_6 (40:1, 30:1, 20:1 and 10:1). ($\lambda_{\text{em}} = 630 \text{ nm}$, $\lambda_{\text{ex}} = 476 \text{ nm}$)

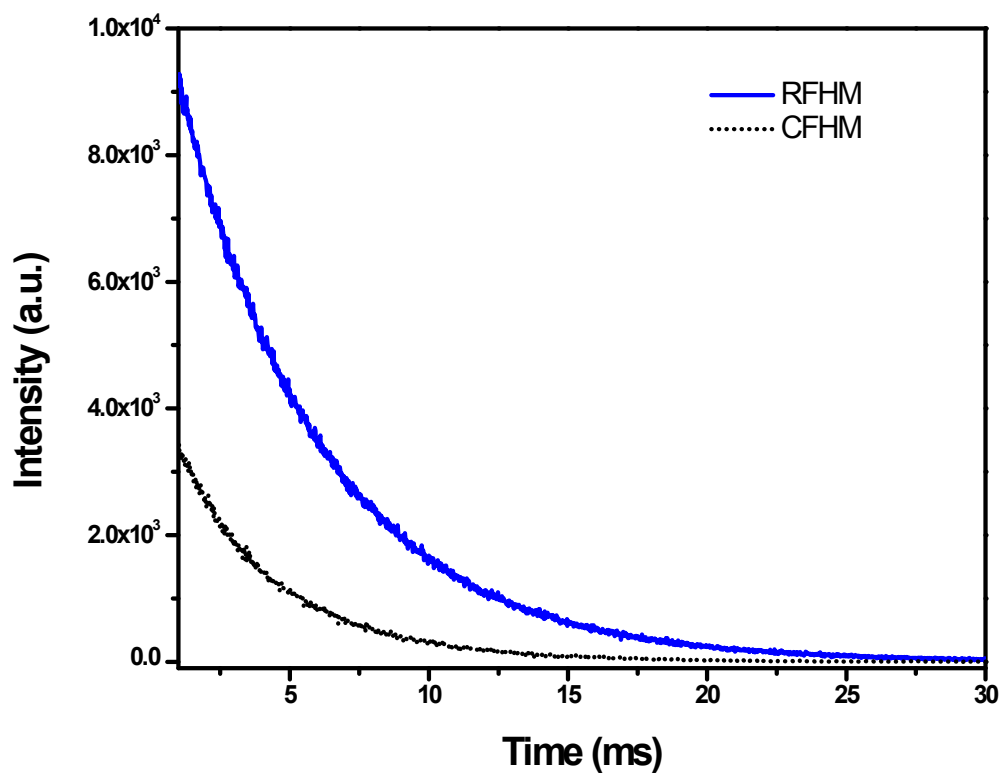


Fig.S5 Decay curves of RHF and CF ($\lambda_{em} = 630 \text{ nm}$, $\lambda_{ex} = 476 \text{ nm}$)

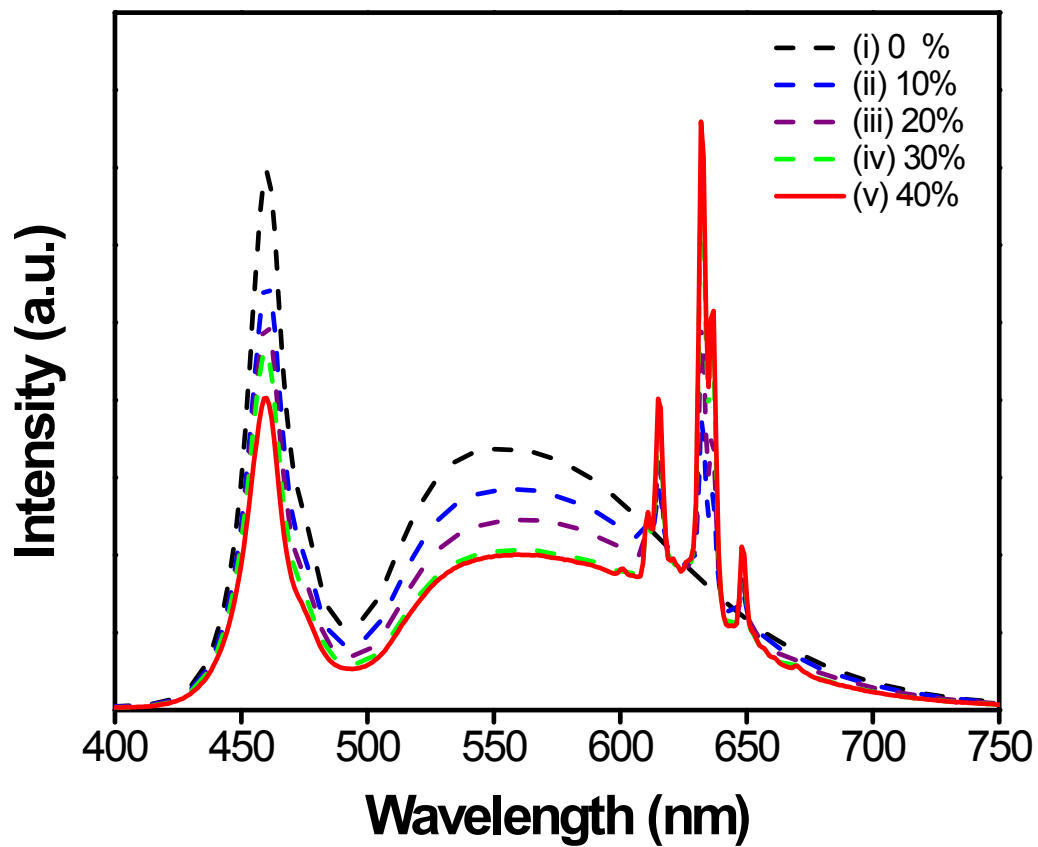


Fig.S6 EL spectra of w-LEDs based on RHFM under 20 mA drive current.