Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

Effectively realizing broadband spectral conversion of UV/visible to near-infrared emission in (Na,K)Mg(La,Gd)TeO_6:Mn^{4+}, Nd^{3+}, Yb^{3+} materials for c-Si solar cells via efficient energy transfer

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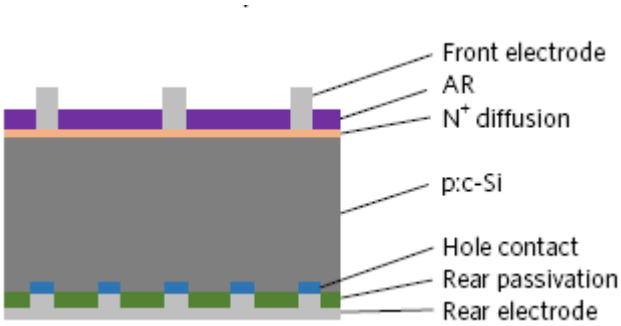

Fig. S1 A schematic diagram of c-Si solar cell model.

(Figure used with permission from K. Yoshikawa, H. Kawasaki, W. Yoshida, T. Irie, K. Konishi, K. Nakano, T. Uto, D. Adachi, M. Kanematsu, H. Uzu and K. Yamamoto, *Nat. Energy*, 2017, **2**, 17032.)

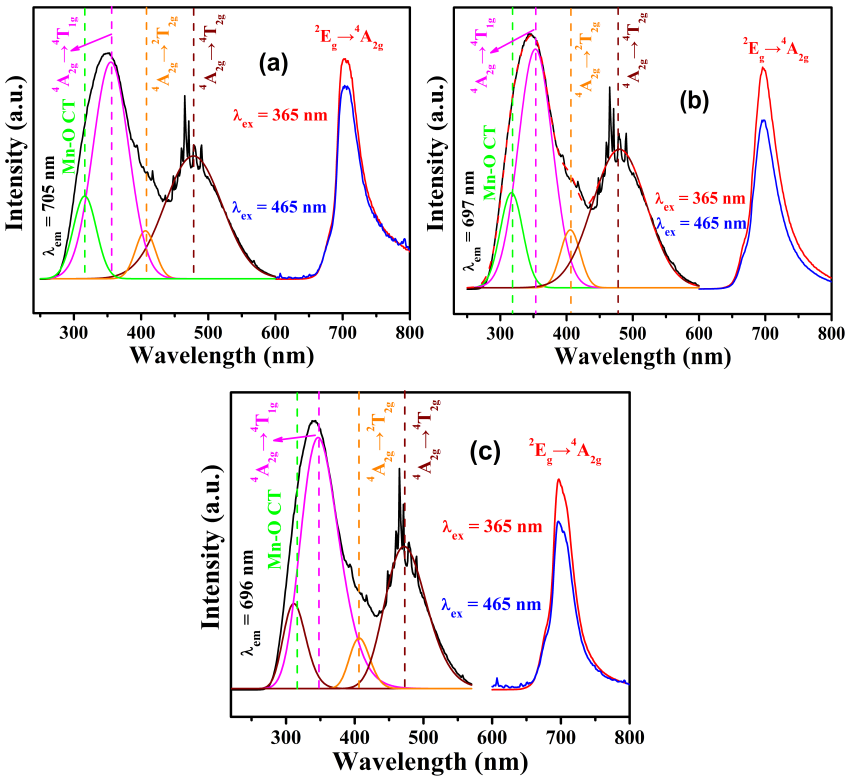

Fig. S2 PL excitation and emission spectra of NML:0.02Mn^{4+} (a), NMG:0.01Mn^{4+} (b) and KML:0.006Mn^{4+} (c) and their respective Gaussian decompositions for the excitation spectra.

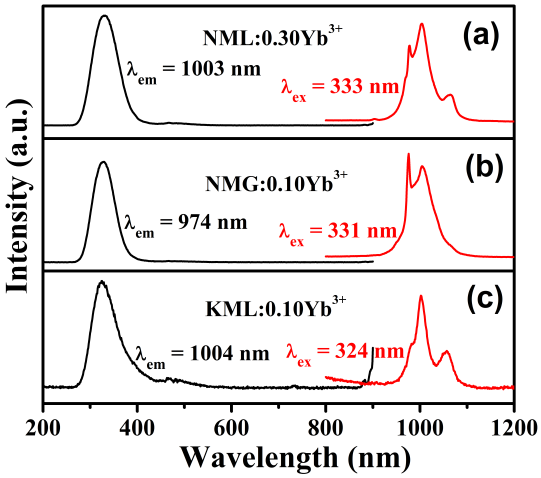

Fig. S3 PL excitation and emission spectra of NML:0.30Yb^{3+} (a), NMG:0.10Yb^{3+} (b) and KML:0.10Yb^{3+} (c).

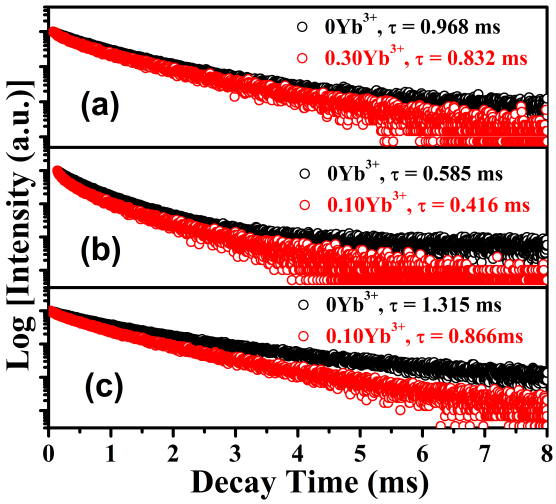

Fig. S4 Decay curves for (a) NML:0.02Mn^{4+} and NML:0.02Mn^{4+}, 0.30Yb^{3+} (λ_{ex} = 365 nm, λ_{em} = 705 nm), (b) NMG:0.01Mn^{4+} and NML:0.01Mn^{4+}, 0.10Yb^{3+} (λ_{ex} = 365 nm, λ_{em} = 697 nm), and (c) NML:0.006Mn^{4+} and NML:0.006Mn^{4+}, 0.10Yb^{3+} (λ_{ex} = 365 nm, λ_{em} = 696 nm)

Table S1 Decay times, energy transfer efficiencies (η_T) and energy transfer probability (P_T) for NML:0.02Mn^{4+}, xNd^{3+} (λ_{ex} = 365 nm, λ_{em} = 705 nm), NMG:0.01Mn^{4+}, yNd^{3+} (λ_{ex} = 365 nm, λ_{em} = 697 nm) and NML:0.006Mn^{4+}, zNd^{3+} (λ_{ex} = 365 nm, λ_{em} = 696 nm).

Concentration (x/y/z)	Decay time (ms)	energy transfer efficiency (η_T)	energy transfer probability (P_T)/ms^{-1}
x = 0	0.986	×	×
x = 0.002	0.887	0.0837	0.09434
x = 0.005	0.826	0.1467	0.1776
x = 0.01	0.729	0.2469	0.3387
x = 0.02	0.667	0.3110	0.4662
x = 0.03	0.611	0.3688	0.6036
x = 0.04	0.561	0.4205	0.7495
y = 0	0.585	×	×
y = 0.004	0.484	0.1726	0.3567
y = 0.012	0.380	0.3504	0.9222
y = 0.02	0.269	0.5402	2.0008
y = 0.03	0.186	0.6821	3.6670
y = 0.04	0.153	0.7385	4.8270
z = 0	1.315	×	×
z = 0.002	1.159	0.1186	0.1024
z = 0.005	0.946	0.2806	0.2966
z = 0.01	0.807	0.3863	0.4787
z = 0.015	0.722	0.4510	0.6246
z = 0.02	0.605	0.5400	0.8924
z = 0.03	0.511	0.6114	1.1965
z = 0.04	0.419	0.6814	1.6262