Preparation of White Light Emitting YVO_4: Ln^{3+} and Silica-coated YVO_4: Ln^{3+} (Ln^{3+} = Eu^{3+}, Dy^{3+}, Tm^{3+}) Nanoparticles by CTAB/n-butanol/hexane/water Microemulsion Route: Energy Transfer and Site Symmetry Studies

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Table S1. V-O charge transfer in the excitation spectra of $YVO_4:Ln^{3+}$ and $YVO_4:Ln^{3+}@SiO_2$ (Ln^{3+} = Eu^{3+}, Tm^{3+} and Dy^{3+}) at different annealing temperatures.

Sl. No.	Sample	V-O Charge transfer (nm)
1	$Eu:YVO_4$ – 500 °C	300
2	$Eu:YVO_4$ – 900 °C	318
3	$Eu:YVO_4$ @SiO_2 – 500 °C	290
4	$Eu:YVO_4$ @SiO_2 – 900 °C	307
5	$Dy:YVO_4$ – 500 °C	300
6	$Dy:YVO_4$ – 900 °C	320
7	$Dy:YVO_4$ @SiO_2 – 500 °C	300
8	$Dy:YVO_4$ @SiO_2 – 900 °C	306
9	$Tm:YVO_4$ – 500 °C	303
10	$Tm:YVO_4$ – 900 °C	320
11	$Tm:YVO_4@SiO_2$ – 500 °C	295
12	$Tm:YVO_4@SiO_2$ – 900 °C	310

Table S2. Integrated area and full width half maximum (FWHM) of the electric and magnetic dipole transition of the emission spectra of Ln^{3+}:YVO_4 and Ln^{3+}:YVO_4@SiO_2 (Ln^{3+} = Eu^{3+}, Tm^{3+} and Dy^{3+}) at different annealing temperatures.

Sl. No.	Sample	Electric dipole transition		Magnetic dipole transition	
		Integrated area	FWHM (nm)	Integrated area	FWHM (nm)
1	Eu:YVO_4 – 500 °C	2.3 x 10^4	6.7	2.1 x 10^3	5.4
2	Eu:YVO_4 – 900 °C	4.4 x 10^5	6.3	5.3 x 10^4	3.7
3	Eu:YVO_4 @SiO_2 – 500 °C	3.5 x 10^5	6.4	3.5 x 10^4	4.1
4	Eu:YVO_4 @SiO_2 – 900 °C	1.6 x 10^7	6.1	1.84 x 10^6	4.1
5	Dy:YVO_4 – 500 °C	1.6 x10^5	6.5	4.3 x 10^5	9.2
6	Dy:YVO_4 – 900 °C	3.9 x 10^5	6.0	1.5 x 10^5	9.1
7	Dy:YVO_4 @SiO_2 – 500 °C	2.2 x 10^3	6.6	8.9 x 10^2	8.8
8	Dy:YVO_4 @SiO_2 – 900 °C	1.3 x 10^6	7.2	4.9 x 10^5	8.8
9	Tm:YVO_4 – 500 °C	1.1 x 10^4	7.8	-	-
10	Tm:YVO_4 – 900 °C	2.5 x 10^5	7.7	-	-
11	Tm:YVO_4@SiO_2 – 500 °C	1.9 x 10^4	9.7	-	-
12	Tm:YVO_4@SiO_2 – 900 °C	6.3 x 10^5	7.9	-	-

Table S3. Lifetime values obtained after the mono-exponential fitting to the data of $YVO_4:Ln^{3+}$ and $YVO_4:Ln^{3+}@SiO_2$ (Ln^{3+} = Eu^{3+}, Tm^{3+} and Dy^{3+}) at different annealing temperatures.

Sl. No.	Sample	Lifetime, τ (μs)	R^2 (Goodness of parameter)
1.	$Tm:YVO_4$ – 500 °C	**13.3**	0.997
2.	$Tm:YVO_4$ – 900 °C	**16.3**	0.991
3.	$Eu:YVO_4$ – 500 °C	**149.9**	0.974
4.	$Eu:YVO_4$ – 900 °C	**475.4**	0.998
5.	$Dy:YVO_4$ – 500 °C	**84.6**	0.987
6.	$Dy:YVO_4$ – 900 °C	**109.1**	0.999
7.	$Tm:Eu:Dy:YVO_4$ – 500 °C (Tm)	**2.5**	0.974
8.	$Tm:Eu:Dy:YVO_4$ – 500 °C (Eu)	**16.8**	0.996
9.	$Tm:Eu:Dy:YVO_4$ – 500 °C (Dy)	**4.9**	0.979
10.	$Tm:Eu:Dy:YVO_4$ – 900 °C (Tm)	**4.1**	0.977
11.	$Tm:Eu:Dy:YVO_4$ – 900 °C (Eu)	**24.4**	0.991
12.	$Tm:Eu:Dy:YVO_4$ – 900 °C (Dy)	**11.7**	0.961
13.	$Tm:YVO_4@SiO_2$ – 500 °C	**5.4**	0.969
14.	$Tm:YVO_4@SiO_2$ – 900 °C	**21.1**	0.998
15.	$Eu:YVO_4@SiO_2$ – 500 °C	**264.9**	0.973
16.	$Eu:YVO_4@SiO_2$ – 900 °C	**629.5**	0.998
17.	$Dy:YVO_4@SiO_2$ – 500 °C	**36.1**	0.924
18.	$Dy:YVO_4@SiO_2$ – 900 °C	**210.9**	0.996
19.	$Tm:Eu:Dy:YVO_4@SiO_2$ – 500 °C (Tm)	**1.9**	0.969
20.	$Tm:Eu:Dy:YVO_4@SiO_2$ – 500 °C (Eu)	**12.4**	0.993
21.	$Tm:Eu:Dy:YVO_4@SiO_2$ – 500 °C (Dy)	**4.5**	0.979
22.	$Tm:Eu:Dy:YVO_4@SiO_2$ – 900 °C (Tm)	**4.5**	0.962
23.	$Tm:Eu:Dy:YVO_4@SiO_2$ – 900 °C (Eu)	**25.6**	0.991
24.	$Tm:Eu:Dy:YVO_4@SiO_2$ – 900 °C (Dy)	**11.9**	0.959

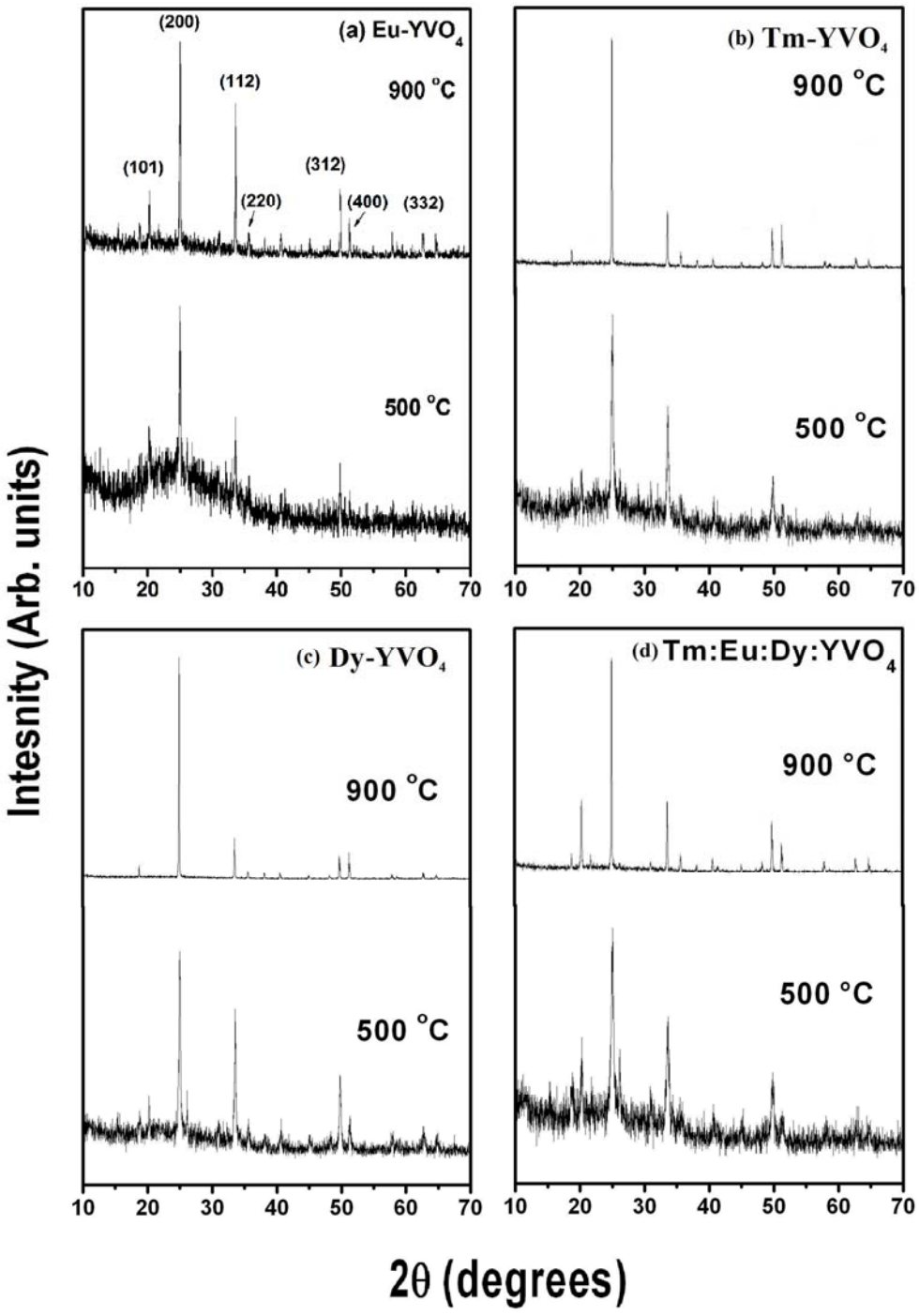

Fig. S1 XRD patterns of YVO_4:Ln^{3+} (Ln^{3+} = Eu^{3+}, Dy^{3+}, Tm^{3+}) at different annealing temperatures (500 and 900 °C).

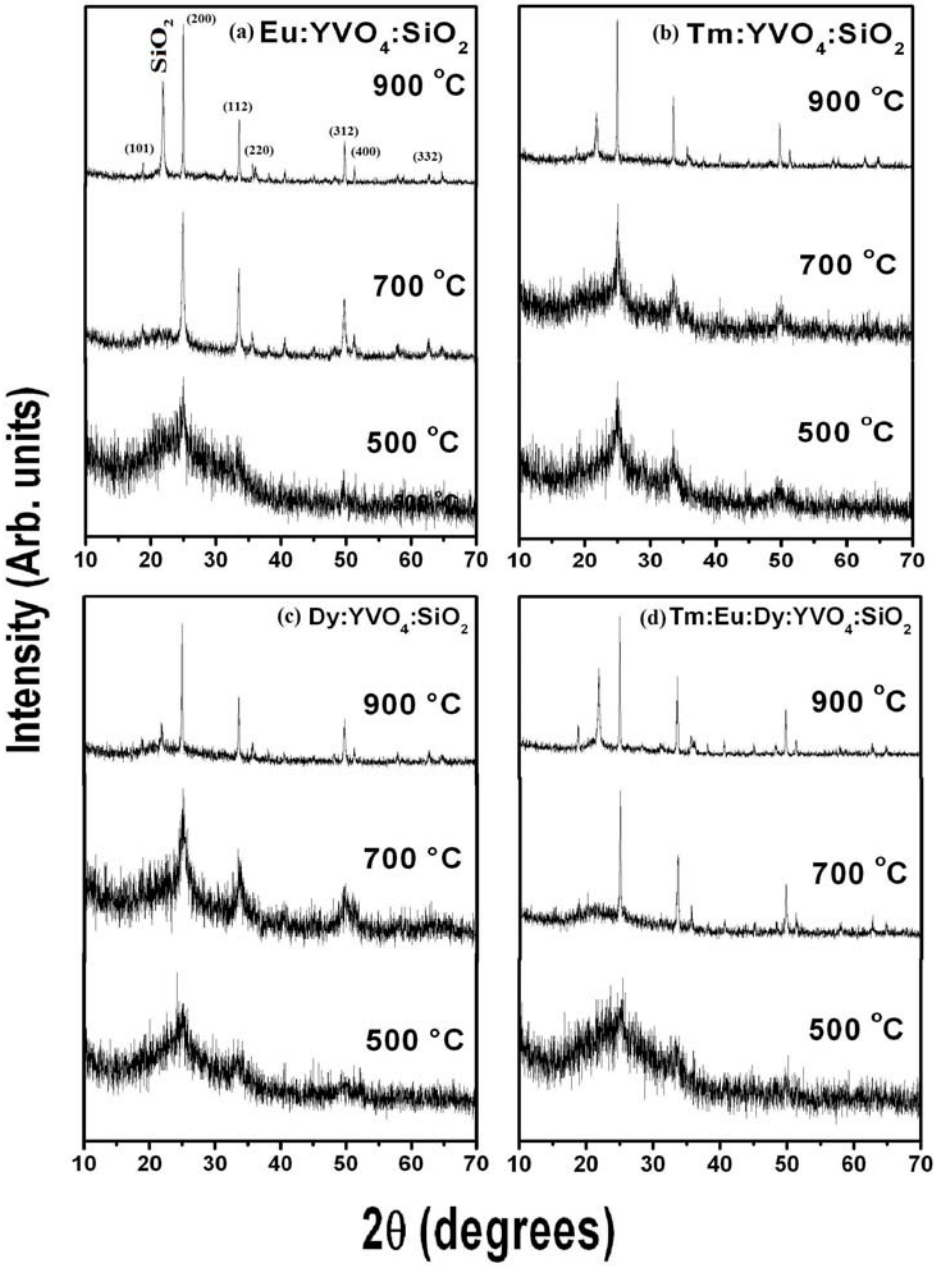

Fig. S2 XRD patterns of $YVO_4:Ln^{3+}@ SiO_2$ (Ln^{3+} = Eu^{3+}, Dy^{3+},Tm^{3+}) at different annealing temperatures (500, 700 and 900 °C).

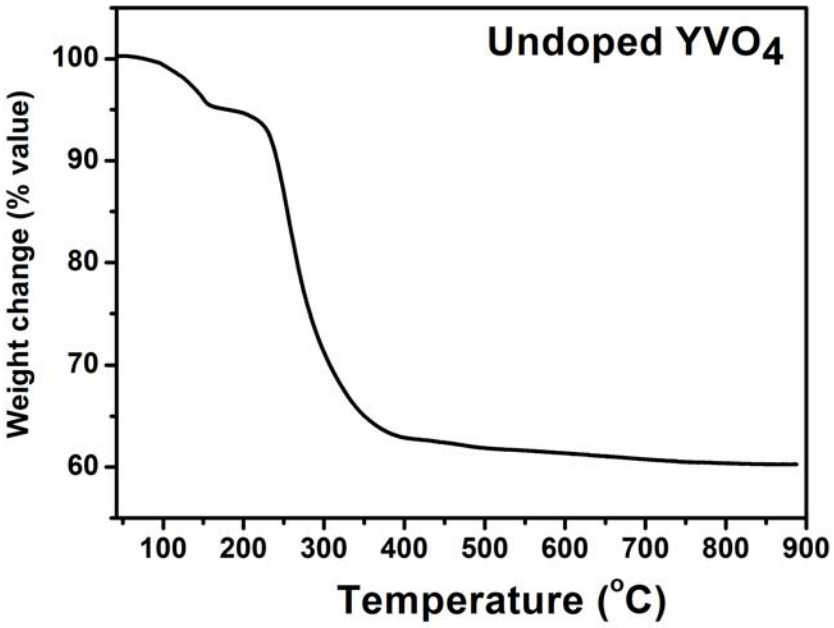

Fig. S3 TGA curve of as-prepared YVO_4 collected from CTAB/n-butanol/hexane/water microemulsion.

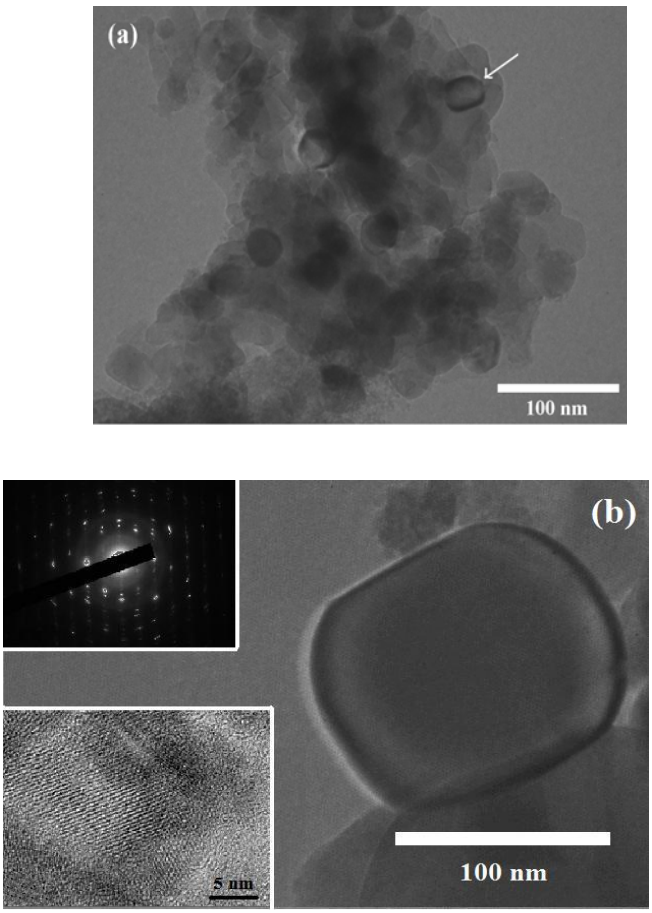

Fig. S4 TEM images of $YVO_4:Tm^{3+}@SiO_2$ annealed at (a) 500 and (b) 900°C. Inset of (b) shows the SAED (Upper) and HRTEM (Lower).

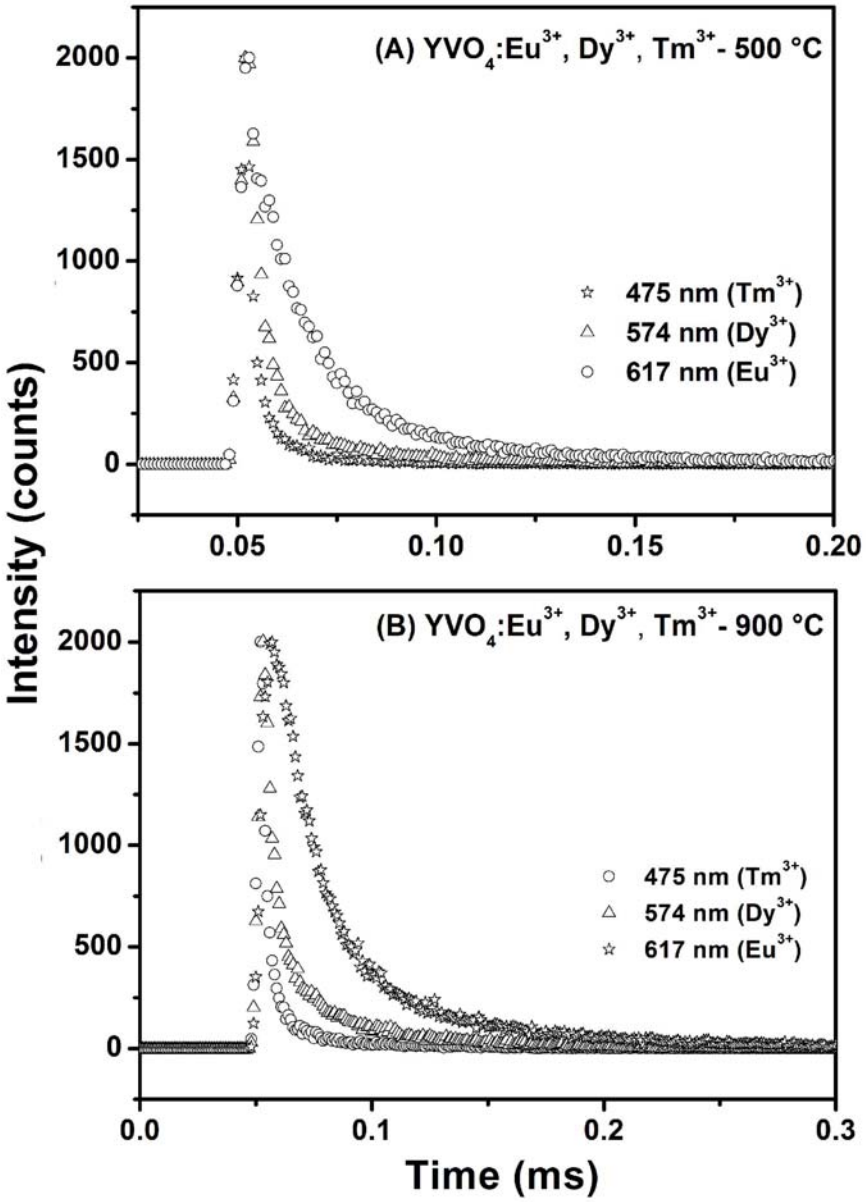

Fig. S5 Luminescence decay of $YVO_4:Ln^{3+}$ (Ln^{3+} = Eu^{3+}, Dy^{3+} and Tm^{3+}) at different annealing temperatures (500 and 900 °C).

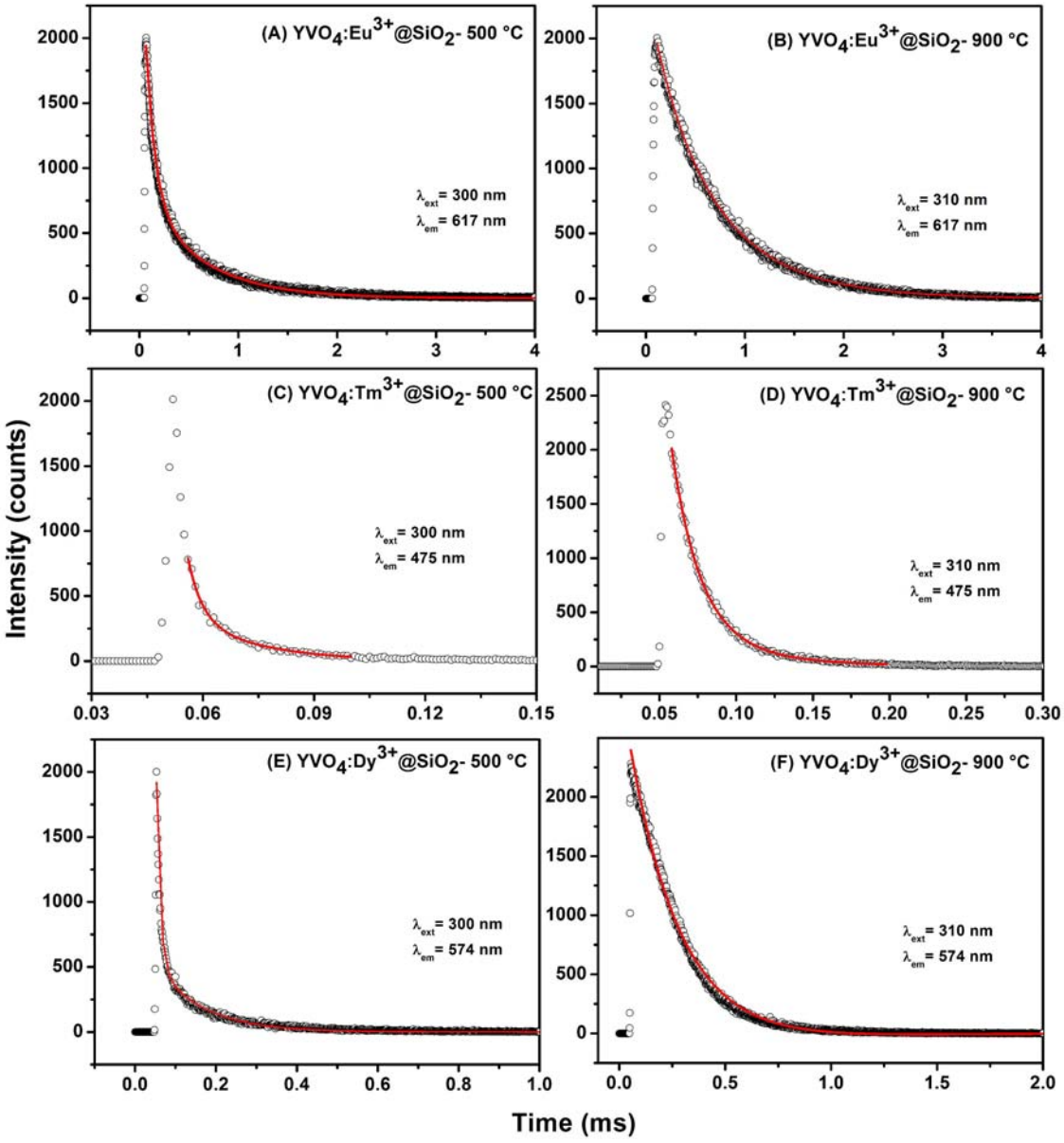

Fig. S6 Luminescence decay of $YVO_4:Ln^{3+}@SiO_2$ (Ln^{3+} = Eu^{3+}, Dy^{3+} or Tm^{3+}) at different annealing temperatures (500 and 900 °C).

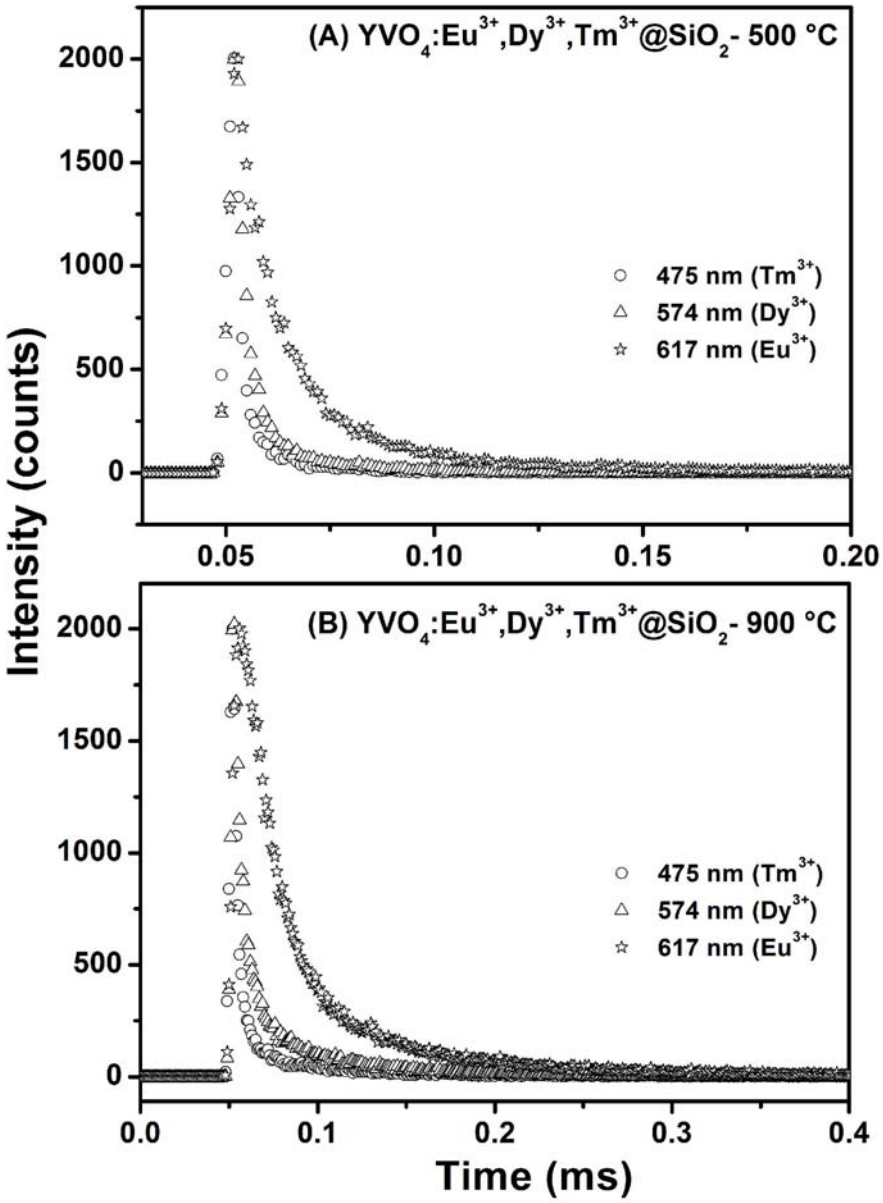

Fig. S7 Luminescence decay of $YVO_4:Ln^{3+}@SiO_2$ (Ln^{3+} = Eu^{3+}, Dy^{3+} and Tm^{3+}) at different annealing temperatures (500 and 900 °C).