Electronic Supplementary Information

Development of Potential Optical Thermometric Material through Photoluminescence of Pr^{3+} in La_2MgTiO_6

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Part A. The details of sample preparation and measurements

A series of Pr^{3+} doped La_2MgTiO_6 was prepared by a high temperature solid-state reaction route using raw materials La_2O_3 (99.99%), $Mg(OH)_2{\cdot}4MgCO_3{\cdot}6H_2O$ (99%), TiO_2 (99.99%), and Pr_6O_{11} (99.99%). According to the nominal chemical formulas $(La_{1-x}Pr_x)_2MgTiO_6$ (x = 0, 0.0025, 0.005, 0.0075, 0.01, 0.02, 0.02, 0.05), the stoichiometric amount of raw materials was ground thoroughly in an agate mortar and then heated to 1573 K in 6 h and kept at this temperature for reaction about 10 h in air atmosphere. Finally, the samples were gradually cooled down to room temperature (RT) and ground into powder.

X-ray powder diffraction using Cu Kα radiation (λ = 0.15405 nm) on a BRUKER D8 ADVANCE powder diffractometer was adopted to examine the phase purity of all final samples at RT. The data were collected with the scanning speed $10°{\cdot}min^{-1}$ and the scanning angle range 10°-70°. High quality XRD data for Rietveld refinement were collected over a scanning angle range from 5° to 105°. The medium-low temperature XRD data were recorded using an Anton Paar TTK 450 temperature controlling unit with liquid nitrogen flow cooling.

The Fourier transform infrared (FT-IR) spectra were measured by a Nicolet 6700-FTIR spectrometer with OMNIC software. The UV-vis diffuse reflectance spectra were collected through a Cary 5000 UV-vis-NIR spectrophotometer equipped with a double out-of-plane Littrow monochromator using $BaSO_4$ as a standard reference.

An Edinburgh FLS 920 combined fluorescence lifetime and steady state spectrometer was used to measure the UV excitation/emission spectra and the luminescence decay curves. A 450W Xe900 lamp was used as the excitation source for steady-state spectra, and that for luminescence decay was a 60W μF flash lamp with a pulse width of 1.5-3 μs and pulse rate of 50 Hz.

Part B. Tables

Table S1 Refined unit cell parameters and refined positions of all atoms of La_2MgTiO_6

Atom	x	y	z	Occpancy
La1	0.9991	0.0215	1/4	1
Ti1	0	1/2	0	0.5
Mg1	0	1/2	0	0.5
O1	0.0730	0.4847	1/4	1
O2	0.7152	0.2866	0.0376	1

Symmetry: Orthorhombic; Space Group: *Pbcm* (62); Cell parameters: a = 5.5632(3) Å; b =5.5575(3) Å; c = 7.8534(3) Å; V = 242.81(2) $Å^3$

Table S2 Interatomic distances between La/Ti(Mg) and O atoms in La_2MgTiO_6

Bond	Distance (Å)	Bond	Distance (Å)
La1-O1	2.3889	Ti1/Mg1-O1	2.0067
La1-O1	2.6067	Ti1/Mg1-O1	2.0067
La1-O1	3.0115	Ti1/Mg1-O2	2.0010
La1-O1	3.1896	Ti1/Mg1-O2	2.0010
La1-O2	2.4308	Ti1/Mg1-O2	2.0143
La1-O2	2.4308	Ti1/Mg1-O2	2.0143
La1-O2	2.7291		
La1-O2	2.7291		
La1-O2	2.7718		
La1-O2	2.7718		
La1-O2	3.2494		
La1-O2	3.2494		

Part C. Figures

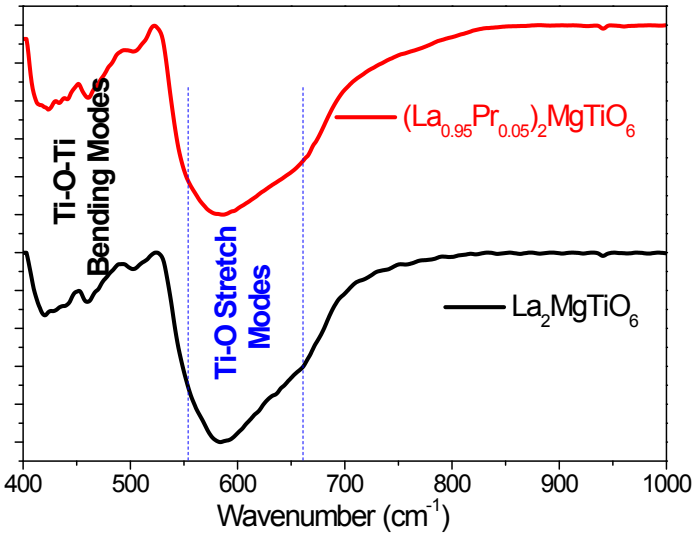


Figure S1 The FT-IR spectra of host compound and $(La_{0.95}Pr_{0.05})_2MgTiO_6$ samples at RT.

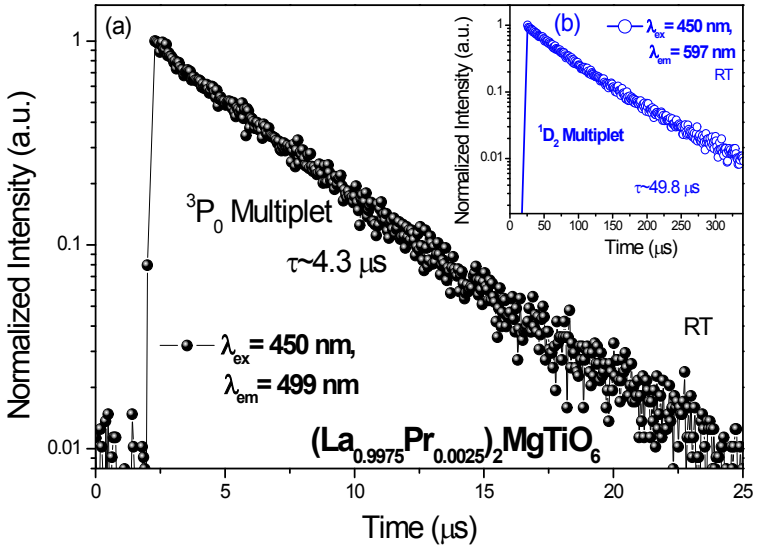
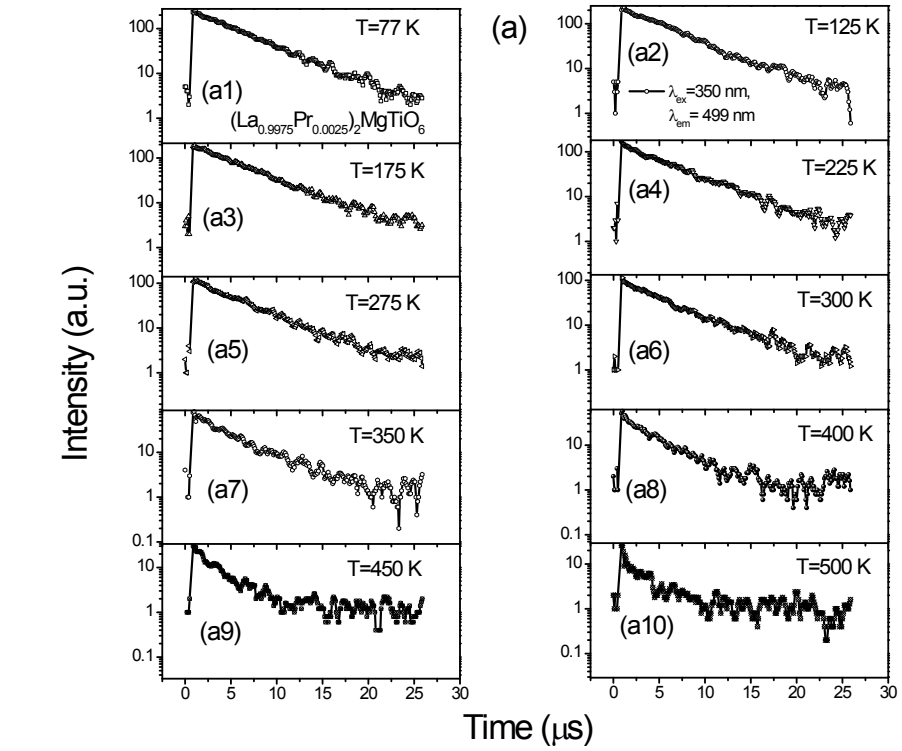


Figure S2 Decay curves of Pr^{3+} $^3P_0$ and $^1D_2$ emissions in $(La_{0.9975}Pr_{0.0025})_2MgTiO_6$ under 450 nm excitation at RT.



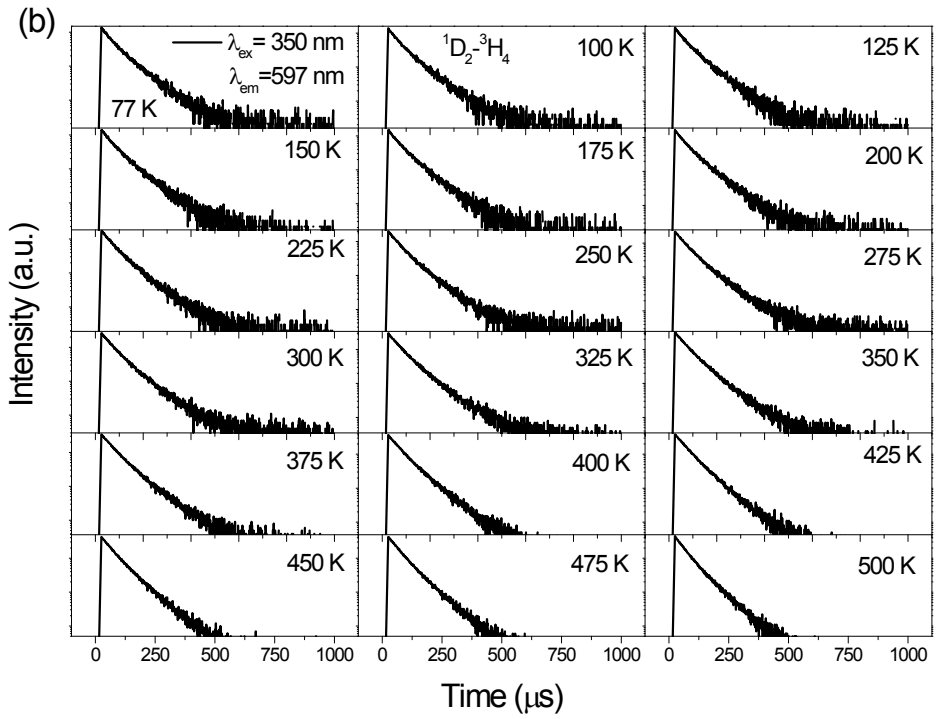


Figure S3 Decay curves of Pr^{3+} $^3P_0$ and $^1D_2$ emissions in $(La_{0.9975}Pr_{0.0025})_2MgTiO_6$ under 350 nm excitation at different temperatures.