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

Supplementary Information

Photostriction in $CaTiO_3$ ceramics under the illumination of light emitting diode

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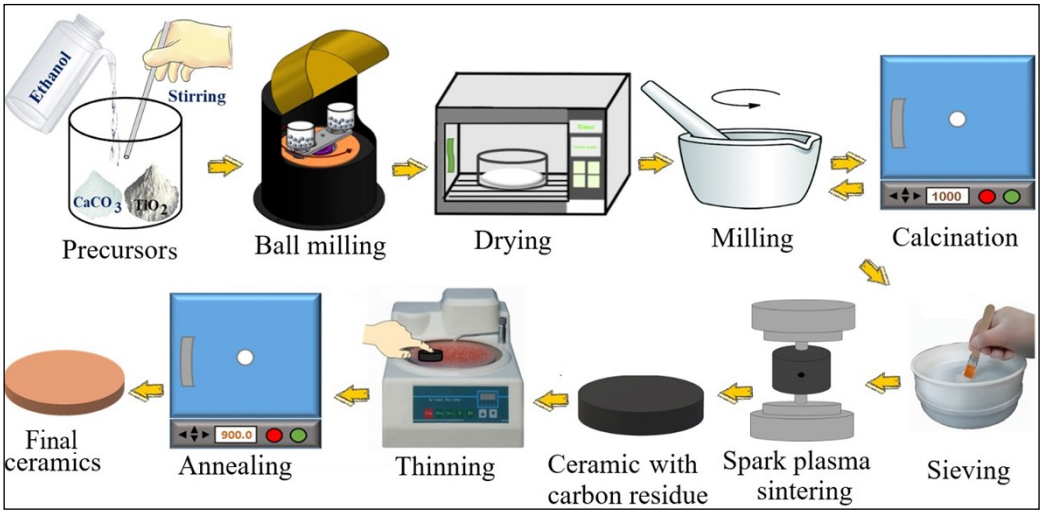

Fig. S1 Schematic representation of the routemap followed in the synthesis of $CaTiO_3$ ceramics.

Photostriction measurement: Based on the research work of B. Kundy's et al [1], the home made setup, as schematically shown in Fig. S1, was used for the photostriction measurement. At first, the $CaTiO_3$ ceramic sample with dimensions $2 \times 7 \times 0.3$ mm^3 was placed at the sample stage and then the suspended part of the sample was irradiated. The photoinduced elongation in the sample pushes the sensitive electrode and thereby changes the separation between the sensitive and base electrode. The corresponding change in the capacitance is measured by an automatic component analyser (TH2838 Automatic Component Analyzer, Tonghui, China). The photostriction $\lambda = \Delta L/L$ is calculated by using the following equations;

$$\lambda=\Delta L/L=(L_2-L_1)/L$$

$$L_1=254.3-515.9\times e^{(-C_1/38.6)}-124.3\times e^{(-C_1/38.59)}-158.6\times e^{(-C_1/583.58)}$$

$$L_2=254.3-515.9\times e^{(-C_2/38.6)}-124.3\times e^{(-C_2/38.59)}-158.6\times e^{(-C_2/583.58)}$$

where C_1 is the capacitance value before illumination, C_2 is the capacitance value under illumination, L is the length of the sample subjected to laser irradiation (which turns out to be 4 mm under LED's 365 and 405 nm, and 3.2 mm under laser light 405 nm.

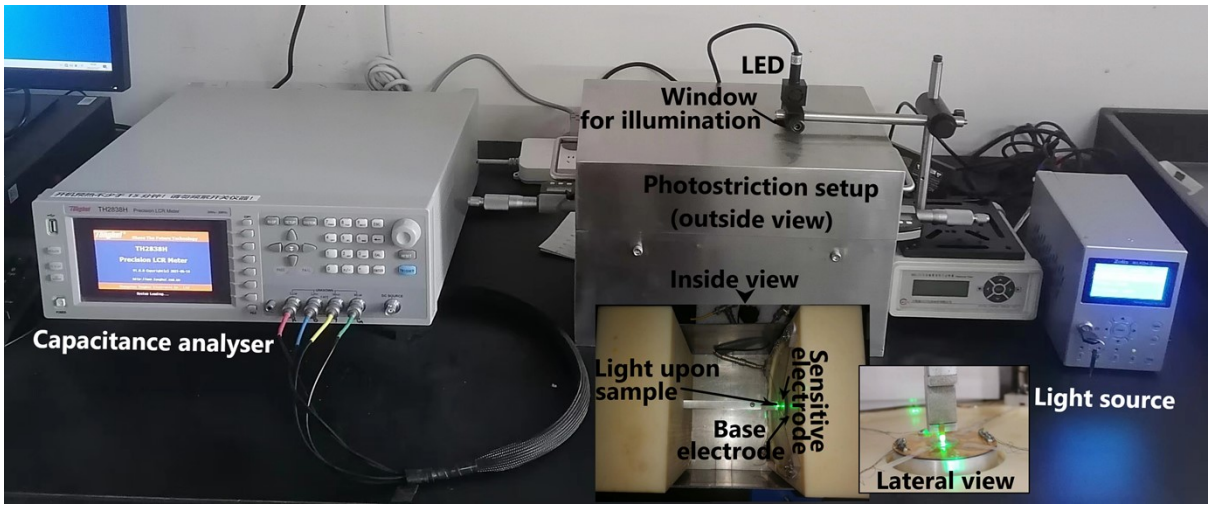

Fig. S2 Schematic representation of photostriction measuring setup.

Table S1. Comparison of the photostrictive parameters of $CaTiO_3$ ceramics with that of the reported materials.

Material	Light		Photostriction	
	Wavelength (nm)	Intensity/fluence	Response $\Delta L/L$ (%)	Efficiency (m^3/W)
PLZT ceramics[2]	365	150 W/m^2	0.01	$3.3*10^{-10}$
$BiFeO_3$ crystal[1]	365	326 W/m^2	0.003	$8.2*10^{-12}$
$CH_3NH_3PbBr_3$ crystal [3]	532	60 W/cm^2	- 1.25	$-5.6*10^{-11}$
$PbTiO_3$ film [4]	400	4.8 mJ/cm^2	0.25	$5.2*10^{-26}$
$BiFeO_3$ film[5]	400	2 mJ/cm^2	0.46	$4*10^{-25}$
$BaTiO_3$ crystal[6]	405	4.8 mJ cm^{-2}	0.25	$5.2*10^{-26}$
BNNPT ceramic[7]	520	67.6	0.38	$1.1*10^{-11}$
$MAPbI_3$ film[8]	532	1 kW/m^2	0.125	$5.0*10^{-12}$
$SrRuO_3$ film[9]	532	625 kW/m^2	1.12	$7.0*10^{-16}$
Te film [10]	633	34	0.01	$2.6*10^{-16}$
$CaFe_2O_4$ ceramic[11]	405	25	0.13	$1.3*10^{-11}$
	520	25	0.11	$1.1*10^{-11}$
	655	25	0.16	$1.0*10^{-11}$
$CaCuTi_4O_{12}$ ceramics[12]	520	67.6 kW/m^2	0.31	$9.2*10^{-12}$
	655	41.2 kW/m^2	0.17	$8.3*10^{-12}$
$Zn_3V_2O_8$ ceramics[13]	405	18 kW/m^2	0.08	$8.8*10^{-12}$
	655	18 kW/m^2	0.05	$5.5*10^{-12}$
$Mg_3V_2O_8$ Ceramics[14]	405	3 kW/m^2	0.015	$1.0*10^{-11}$
	520	20 kW/m^2	0.09	$9.0*10^{-12}$
	655	3 kW/m^2	0.024	$1.5*10^{-11}$
$CaTiO_3$ ceramics	LED-365	2 kW/m^2	0.015	0.22×10^{-10}
	LED-405	2 kW/m^2	0.012	0.19×10^{-10}

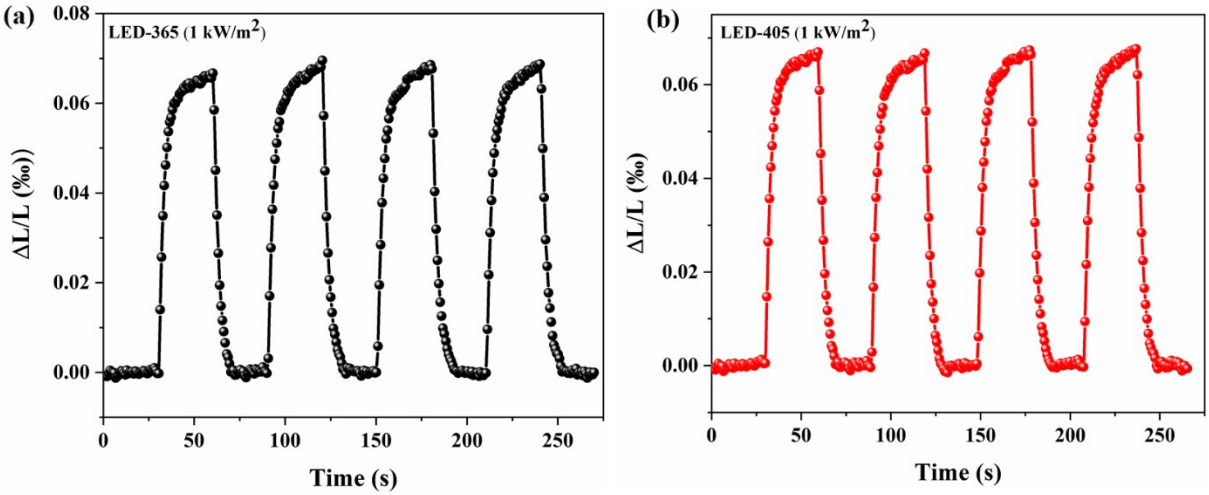

Fig. S3 Reproducibility of photostriction ΔL/L of $CaTiO_3$ ceramic sample at 1 sun illumination under; (a) LED 365 nm, and (b) 405 nm.

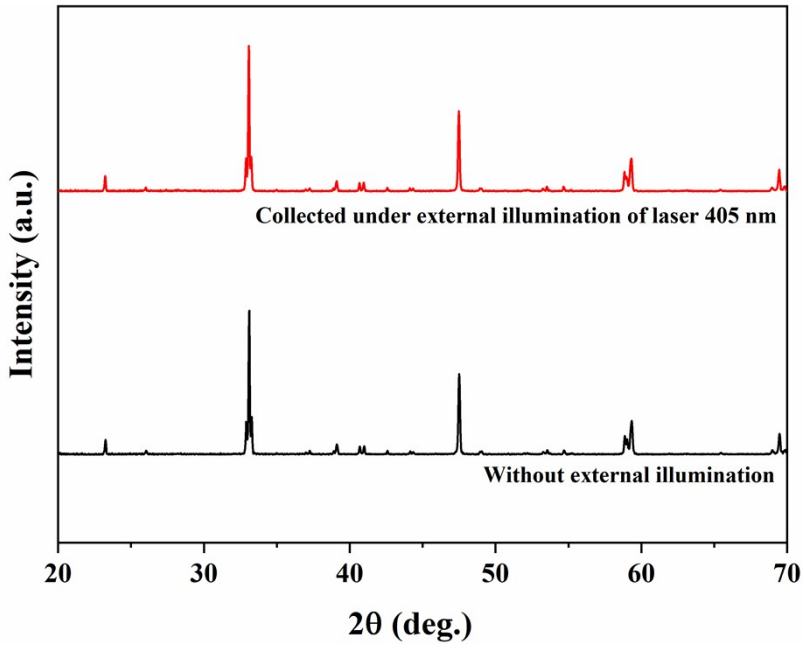

Fig. S4. X-ray diffraction patterns of $CaTiO_3$ ceramic collected with and without external laser illumination.

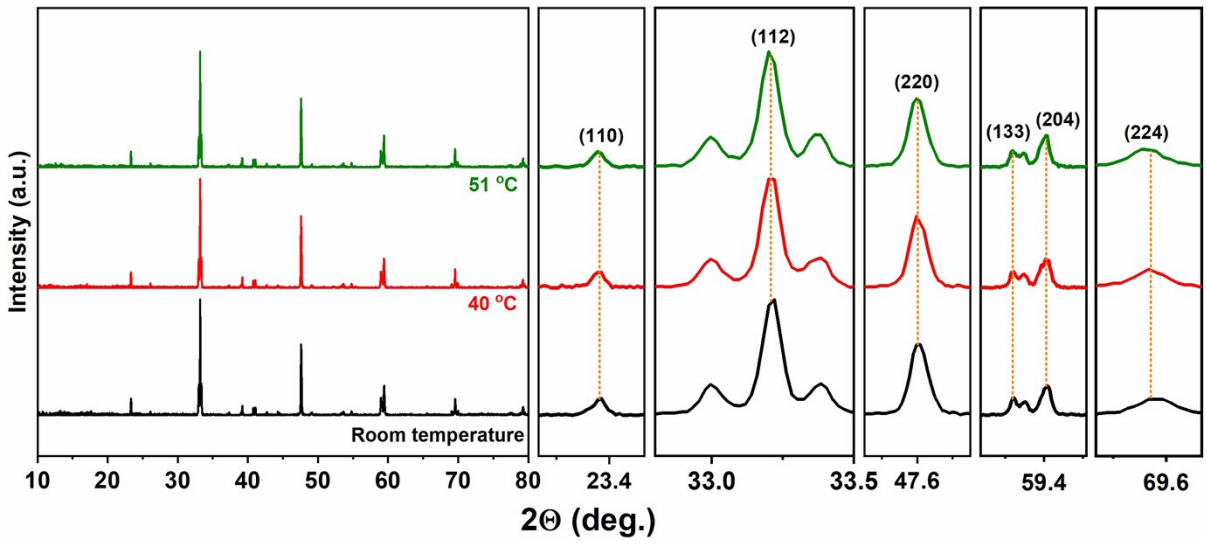

Fig. S5 Temperature dependent X-ray diffraction patterns of $CaTiO_3$ ceramics.

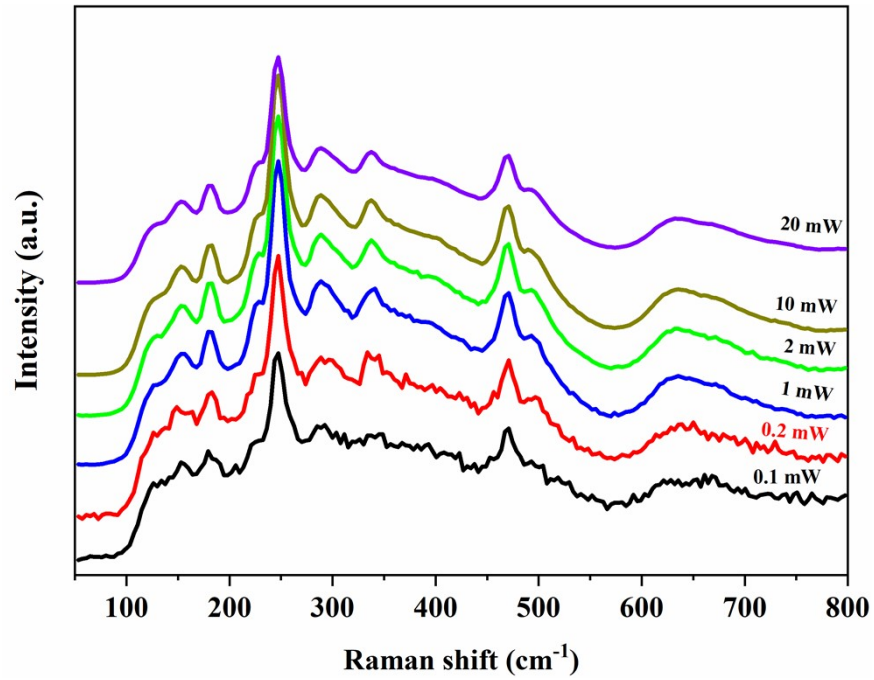

Fig. S6 Raman spectra's of $CaTiO_3$ ceramics at various laser (473 nm) powers.

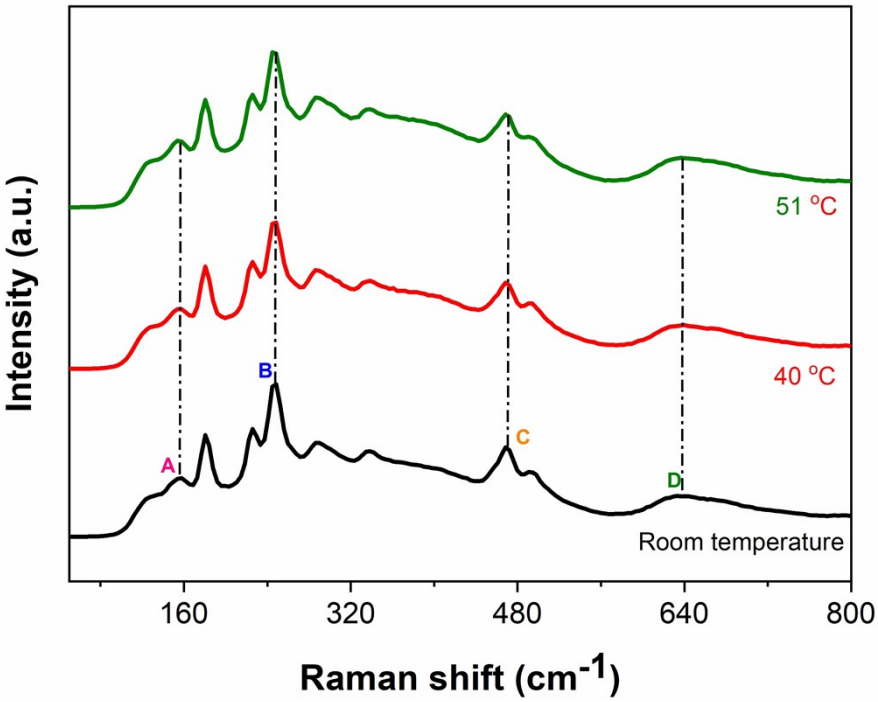

Fig. S7 Temperature dependent Raman spectra's of $CaTiO_3$ ceramics recorded while excitation wavelength 473 nm (at power of 20 mW).

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