Supporting Information

Table S1. Refined structure data of the initial samples for $BiPO_4$, $Bi_{0.98}Eu_{0.02}PO_4$, $Bi_{0.95}Eu_{0.05}PO_4$, and $Bi_{0.93}Eu_{0.07}PO_4$ (space group $P_{21/m(11)}$).

Sample	Atom (ox.)	occupancy	x	y	z	Uiso
$BiPO_4$	Bi(+3)	1.00	0.2848	0.1450	0.0869	0.004
	P(+5)	1.00	0.2958	0.1581	0.6142	0.004
	O1(-2)	1.00	0.2559	0.0049	0.4390	0.011
	O2(-2)	1.00	0.3786	0.3308	0.5203	0.004
	O3(-2)	1.00	0.4657	0.0964	0.8208	0.013
	O4(-2)	1.00	0.1095	0.2045	0.7052	0.016
$Bi_{0.95}Eu_{0.05}PO_4$	Bi(+3)	0.95	0.2852	0.1434	0.0888	0.004
	Eu(+3)	0.05	0.2852	0.1434	0.0888	0.004
	P(+5)	1.00	0.3104	0.1649	0.6104	0.007
	O1(-2)	1.00	0.2209	0.0118	0.4797	0.106
	O2(-2)	1.00	0.3836	0.3336	0.5098	0.006
	O3(-2)	1.00	0.4588	0.1168	0.8219	0.032
	O4(-2)	1.00	0.1207	0.2039	0.6945	0.003
$Bi_{0.98}Eu_{0.02}PO_4$	Bi(+3)	0.98	0.2849	0.1437	0.0876	0.005
	Eu(+3)	0.02	0.2849	0.1437	0.0876	0.005
	P(+5)	1.00	0.2906	0.1745	0.6206	0.008
	O1(-2)	1.00	0.2648	0.0137	0.4467	0.009
	O2(-2)	1.00	0.3915	0.3048	0.5274	0.011
	O3(-2)	1.00	0.4657	0.0964	0.8208	0.013
	O4(-2)	1.00	0.1095	0.2045	0.7052	0.016
$Bi_{0.93}Eu_{0.07}PO_4$	Bi(+3)	0.93	0.2845	0.1443	0.0861	0.002
	Eu(+3)	0.07	0.2845	0.1443	0.0861	0.002
	P(+5)	1.00	0.2884	0.1932	0.5741	0.008
	O1(-2)	1.00	0.2236	0.0098	0.4190	0.021
	O2(-2)	1.00	0.3965	0.3415	0.5108	0.015
	O3(-2)	1.00	0.4734	0.1142	0.8157	0.002
	O4(-2)	1.00	0.097	0.1721	0.6851	0.036

Table S2. Refined structure data of the initial samples for $Bi_{0.93}Er_{0.05}Eu_{0.02}PO_4$, $Bi_{0.93}Nd_{0.05}Eu_{0.02}PO_4$, $Bi_{0.93}Ce_{0.05}Eu_{0.02}PO_4$, and $Bi_{0.93}La_{0.05}Eu_{0.02}PO_4$ (space group $P_{21/m(11)}$).

Sample	Atom (ox.)	occupancy	x	y	z	Uiso
$Bi_{0.93}Er_{0.05}Eu_{0.02}PO_4$	Bi(+3)	0.93	0.2982	0.1455	0.0968	0.009
	Er(+3)	0.05	0.2982	0.1455	0.0968	0.009
	Eu(+3)	0.02	0.2982	0.1455	0.0968	0.009
	P(+5)	1.00	0.2298	0.1609	0.5798	0.008
	O1(-2)	1.00	0.2405	0.0127	0.479	0.008
	O2(-2)	1.00	0.3741	0.3205	0.5173	0.090
	O3(-2)	1.00	0.3952	0.1010	0.7585	0.012
	O4(-2)	1.00	0.1696	0.1859	0.6824	0.016
$Bi_{0.93}Nd_{0.05}Eu_{0.02}PO_4$	Bi(+3)	0.93	0.2850	0.1454	0.0892	0.013
	Nd(+3)	0.05	0.2850	0.1454	0.0892	0.013
	Eu(+3)	0.02	0.2850	0.1454	0.0892	0.013
	P(+5)	1.00	0.3039	0.1684	0.5993	0.016
	O1(-2)	1.00	0.2769	0.0129	0.449	0.026
	O2(-2)	1.00	0.3794	0.013	0.5169	0.014
	O3(-2)	1.00	0.4538	0.1030	0.8213	0.003
	O4(-2)	1.00	0.1361	0.1497	0.6915	0.008
$Bi_{0.93}Ce_{0.05}Eu_{0.02}PO_4$	Bi(+3)	0.93	0.2847	0.1449	0.0901	0.001
	Ce(+3)	0.05	0.2847	0.1449	0.0901	0.001
	Eu(+3)	0.02	0.2847	0.1449	0.0901	0.001
	P(+5)	1.00	0.3062	0.156	0.5995	0.041
	O1(-2)	1.00	0.2665	0.0023	0.468	0.018
	O2(-2)	1.00	0.3738	0.3473	0.5086	0.024
	O3(-2)	1.00	0.4563	0.1078	0.8091	0.022
	O4(-2)	1.00	0.1145	0.1942	0.6769	0.018
$Bi_{0.93}La_{0.05}Eu_{0.02}PO_4$	Bi(+3)	0.93	0.2840	0.1455	0.0871	0.009
	La(+3)	0.05	0.2840	0.1455	0.0871	0.009
	Eu(+3)	0.02	0.2840	0.1455	0.0871	0.009
	P(+5)	1.00	0.2981	0.165	0.6203	0.006
	O1(-2)	1.00	0.2478	0.0044	0.444	0.017
	O2(-2)	1.00	0.3807	0.3159	0.5115	0.009
	O3(-2)	1.00	0.4626	0.0918	0.8136	0.016
	O4(-2)	1.00	0.1089	0.1872	0.6769	0.019

Table S3. Structural refinement parameters for $Bi_{0.93}La_{0.05}Eu_{0.02}PO_4$ calcined at different temperature by Rietveld refinement using GSAS program.

Temperature (°C)	R_{wp}	R_p	R_{-blnk}	χ^2
600	0.1327	0.0970	0.1127	1.914
700	0.0906	0.0635	0.0690	1.784
800	0.1394	0.0966	0.1110	2.028
900	0.1477	0.1050	0.1201	2.370

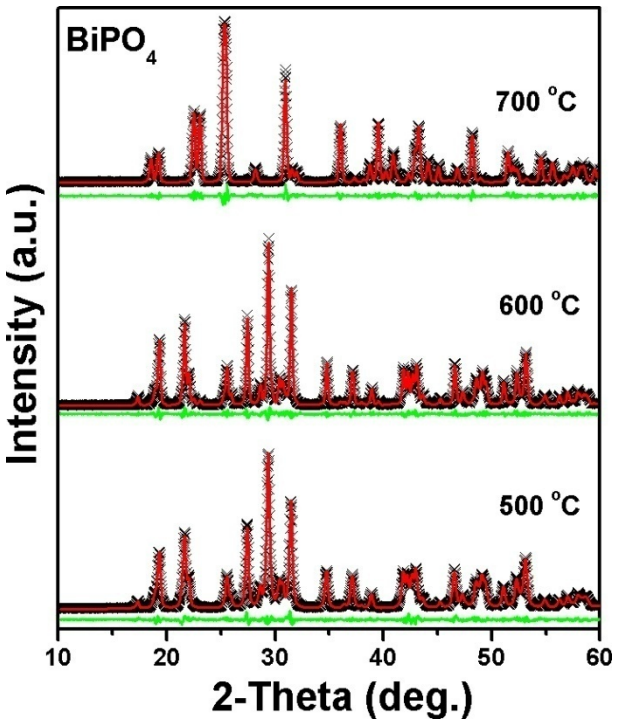

Fig. S1 XRD patterns along with the Rietveld refinements for undoped $BiPO_4$ prepared after calcinations at given temperatures.

Table S4. Structural refinement parameters for undoped $BiPO_4$ calcined at different temperature by Rietveld refinement using GSAS program.

Temperature (°C)	R_{wp}	R_p	R_{-blnk}	χ^2
500	0.0779	0.0565	0.0650	2.020
600	0.0912	0.0618	0.0717	1.379
700	0.1091	0.0719	0.0877	1.732

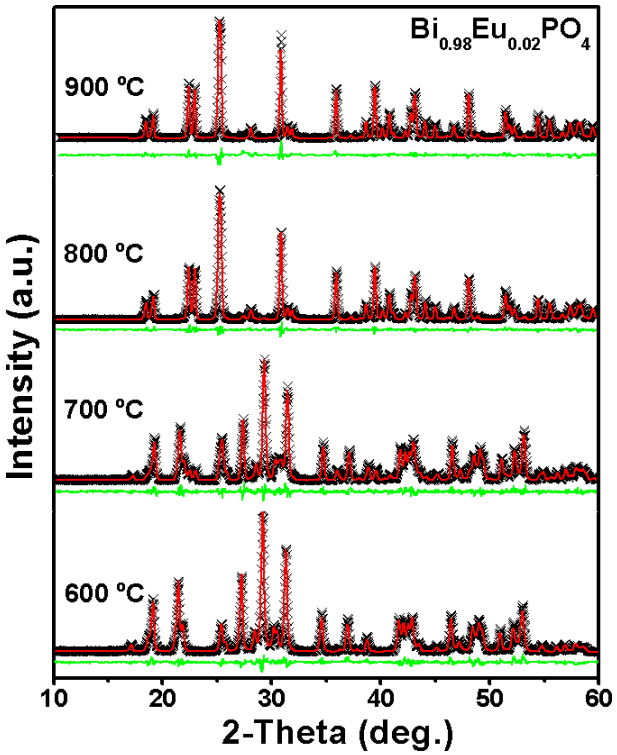

Fig. S2 XRD patterns along with the Rietveld refinements for $Bi_{0.98}Eu_{0.02}PO_4$ prepared after calcinations at given temperatures.

5 **Table S5.** Structural refinement parameters for $Bi_{0.98}Eu_{0.02}PO_4$ calcined at different temperature by Rietveld refinement using GSAS program.

Temperature (ºC)	R_{wp}	R_p	R_{-blnk}	χ^2
600	0.1176	0.0846	0.1004	1.646
700	0.1232	0.0883	0.1023	1.448
800	0.9970	0.0696	0.0807	2.132
900	0.1295	0.0854	0.1059	2.212

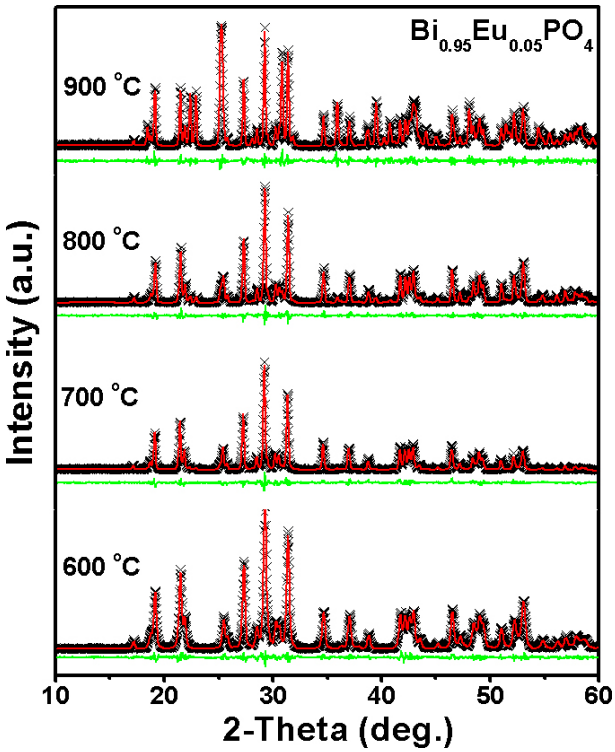

Fig. S3 XRD patterns along with the Rietveld refinements for $Bi_{0.95}Eu_{0.05}PO_4$ prepared after calcinations at given temperatures.

Table S6. Structural refinement parameters for $Bi_{0.95}Eu_{0.05}PO_4$ calcined at different temperature by Rietveld refinement using GSAS program.

Temperature (°C)	R_{wp}	R_p	R_{-blnk}	χ^2
600	0.0981	0.0677	0.0748	1.326
700	0.1475	0.1063	0.1273	1.634
800	0.1241	0.0881	0.1028	1.537
900	0.1303	0.0929	0.1106	1.536

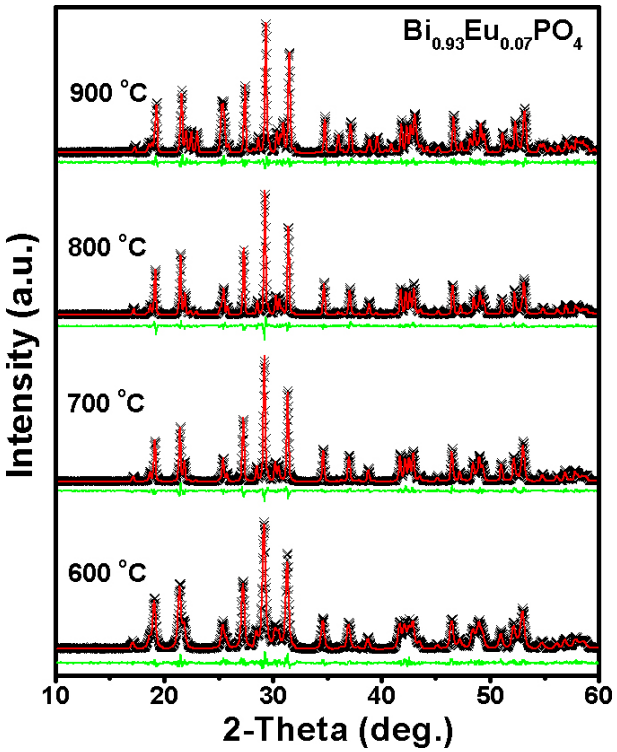

Fig. S4 XRD patterns along with the Rietveld refinements for $Bi_{0.93}Eu_{0.07}PO_4$ prepared after calcinations at given temperatures.

5 **Table S7.** Structural refinement parameters for $Bi_{0.93}Eu_{0.07}PO_4$ calcined at different temperature by Rietveld refinement using GSAS program.

Temperature (°C)	R_{wp}	R_p	R_{-blnk}	χ^2
600	0.1075	0.0769	0.0843	1.420
700	0.1161	0.0859	0.0966	1.641
800	0.1361	0.0938	0.1126	2.089
900	0.1271	0.0890	0.1041	1.465

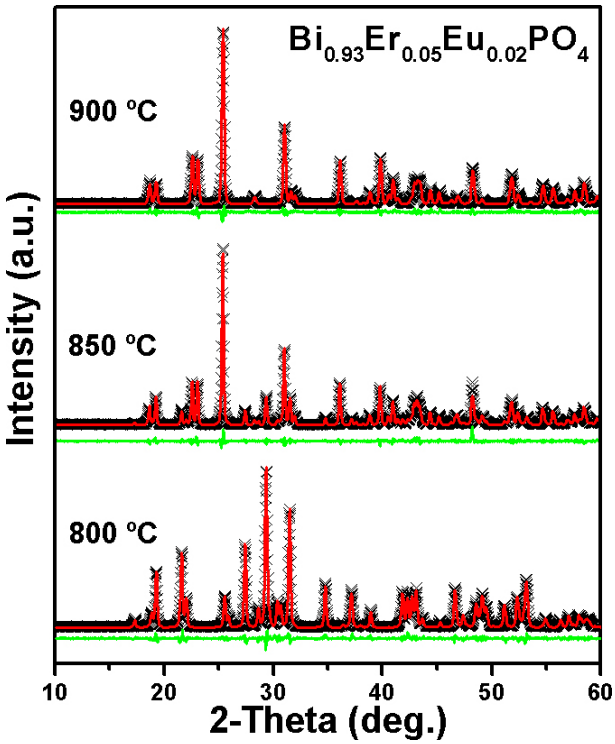

Fig. S5 XRD patterns along with the Rietveld refinements for $Bi_{0.93}Er_{0.05}Eu_{0.02}PO_4$ prepared after calcinations at given temperatures.

Table S8. Structural refinement parameters for $Bi_{0.93}Er_{05}Eu_{0.02}PO_4$ calcined at different temperature by Rietveld refinement 5 using GSAS program.

Temperature (°C)	R_{wp}	R_p	R_{-blnk}	χ^2
800	0.1103	0.0789	0.0884	1.517
850	0.1231	0.0898	0.1065	1.687
900	0.1267	0.0863	0.1006	1.868

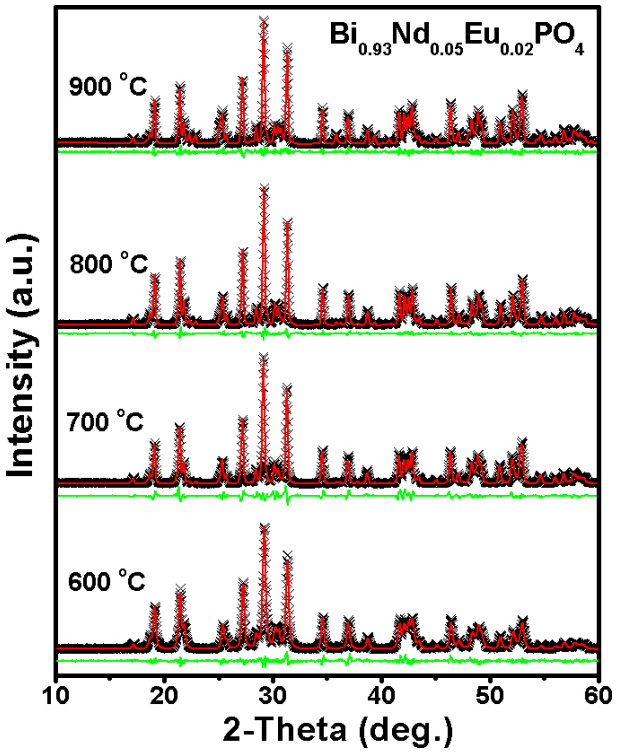

Fig. S6 XRD patterns along with the Rietveld refinements for $Bi_{0.93}Nd_{0.05}Eu_{0.02}PO_4$ prepared after calcinations at given temperatures.

Table S9. Structural refinement parameters for $Bi_{0.93}Nd_{0.05}Eu_{0.02}PO_4$ calcined at different temperature by Rietveld refinement using GSAS program.

Temperature (°C)	R_{wp}	R_p	R_{-blnk}	χ^2
600	0.1201	0.0864	0.1013	1.575
700	0.1245	0.0971	0.1194	2.097
800	0.0802	0.0567	0.0625	2.057
900	0.1082	0.0795	0.0874	1.550

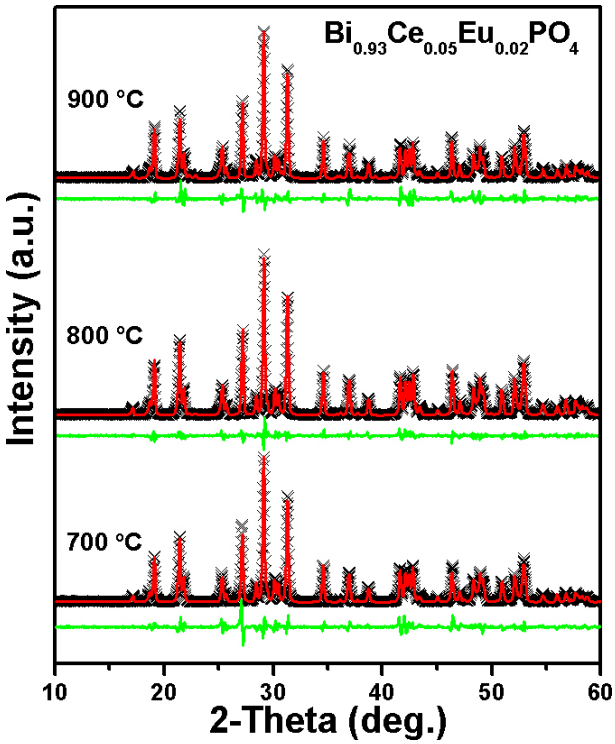

Fig. S7 XRD patterns along with the Rietveld refinements for $Bi_{0.93}Ce_{0.05}Eu_{0.02}PO_4$ prepared after calcinations at given temperatures.

Table S10. Structural refinement parameters for $Bi_{0.93}Ce_{0.05}Eu_{0.02}PO_4$ calcined at different temperature by Rietveld refinement using GSAS program.

Temperature (°C)	R_{wp}	R_p	R_{-blnk}	χ^2
700	0.1256	0.0905	0.1045	1.571
800	0.1235	0.1125	0.1556	1.192
900	0.1449	0.0971	0.1214	2.090

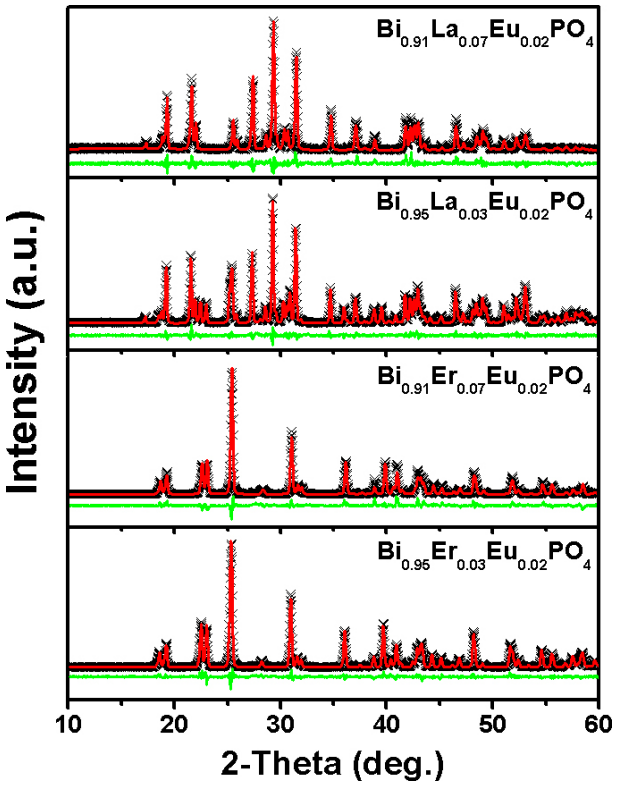

Fig. S8 XRD patterns along with the Rietveld refinements for $Bi_{0.95}La_{0.03}Eu_{0.02}PO_4$, $Bi_{0.91}La_{0.07}Eu_{0.02}PO_4$, $Bi_{0.95}Er_{0.03}Eu_{0.02}PO_4$, and $Bi_{0.91}Er_{0.07}Eu_{0.02}PO_4$ prepared after calcinations at 900 °C.

5 **Table S11.** Structural refinement parameters for $Bi_{0.95}La_{0.03}Eu_{0.02}PO_4$, $Bi_{0.91}La_{0.07}Eu_{0.02}PO_4$, $Bi_{0.95}Er_{0.03}Eu_{0.02}PO_4$, and $Bi_{0.91}Er_{0.07}Eu_{0.02}PO_4$ calcined at 900 °C by Rietveld refinement using GSAS program.

Temperature (°C)	R_{wp}	R_p	R_{-blnk}	χ^2
$Bi_{0.95}La_{0.03}Eu_{0.02}PO_4$	0.1076	0.0750	0.0854	1.712
$Bi_{0.91}La_{0.07}Eu_{0.02}PO_4$	0.1410	0.0914	0.1202	1.691
$Bi_{0.95}Er_{0.03}Eu_{0.02}PO_4$	0.1338	0.0950	0.1113	2.151
$Bi_{0.91}Er_{0.07}Eu_{0.02}PO_4$	0.1299	0.0933	0.1246	2.218

From the above data fit, it can be seen that the refined phase content is reliable.

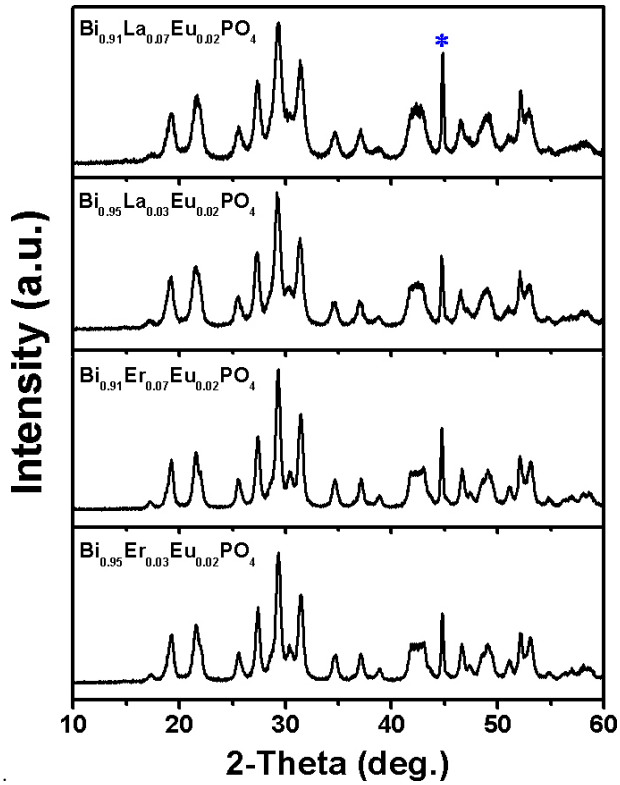

Fig. S9 XRD patterns of the samples $Bi_{0.95}La_{0.03}Eu_{0.02}PO_4$, $Bi_{0.91}La_{0.07}Eu_{0.02}PO_4$, $Bi_{0.95}Er_{0.03}Eu_{0.02}PO_4$, and $Bi_{0.91}Er_{0.07}Eu_{0.02}PO_4$ synthesized by a room co-precipitation method. The peaks denoted by symbol * represents the diffractions of the internal standard of nickel.

By XRD analysis, we can know that the pure LTMP phase samples can be obtained.