The Effect of Light Rare Earth Elements Substitution in $Yb_{14}MnSb_{11}$ on Thermoelectric Properties

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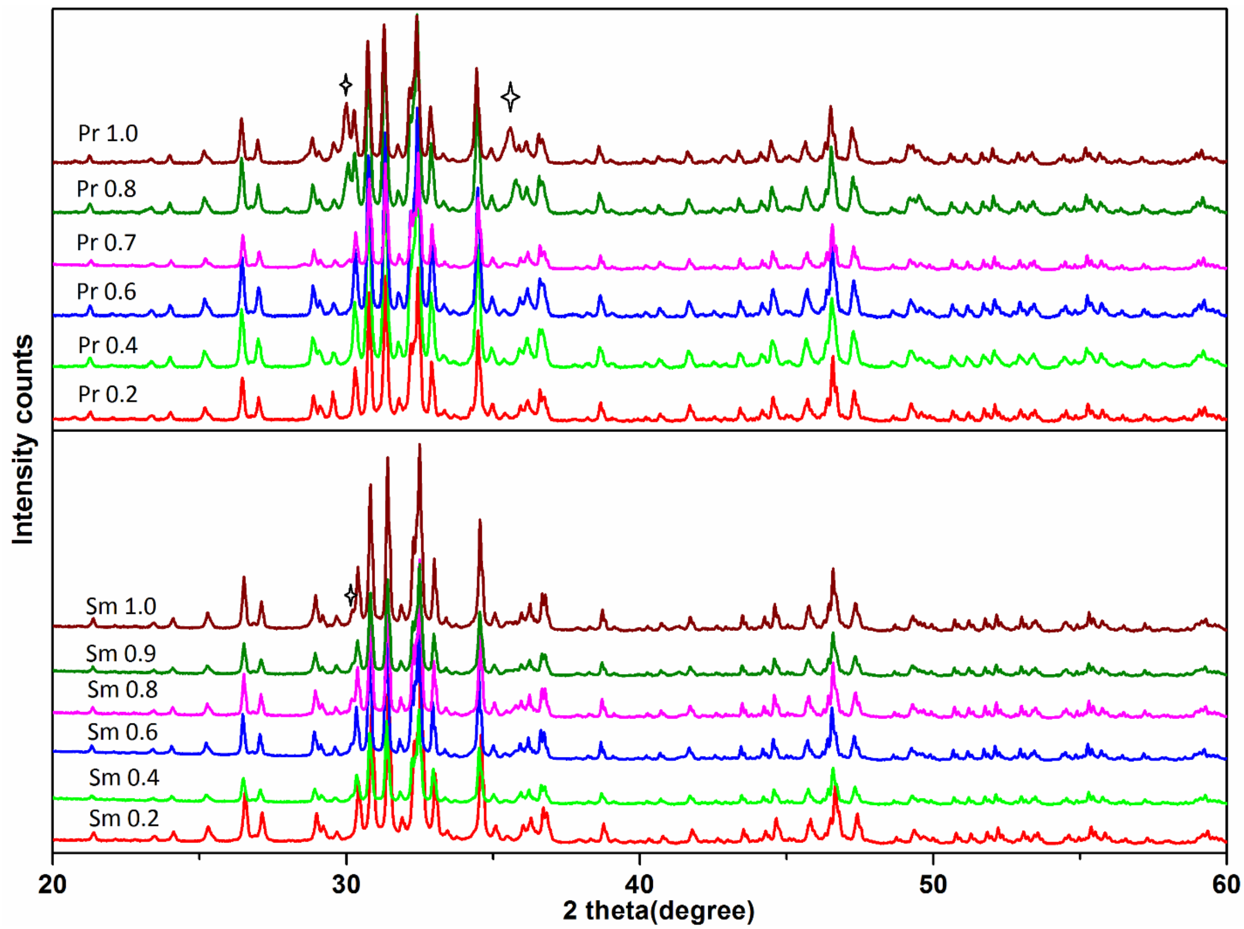
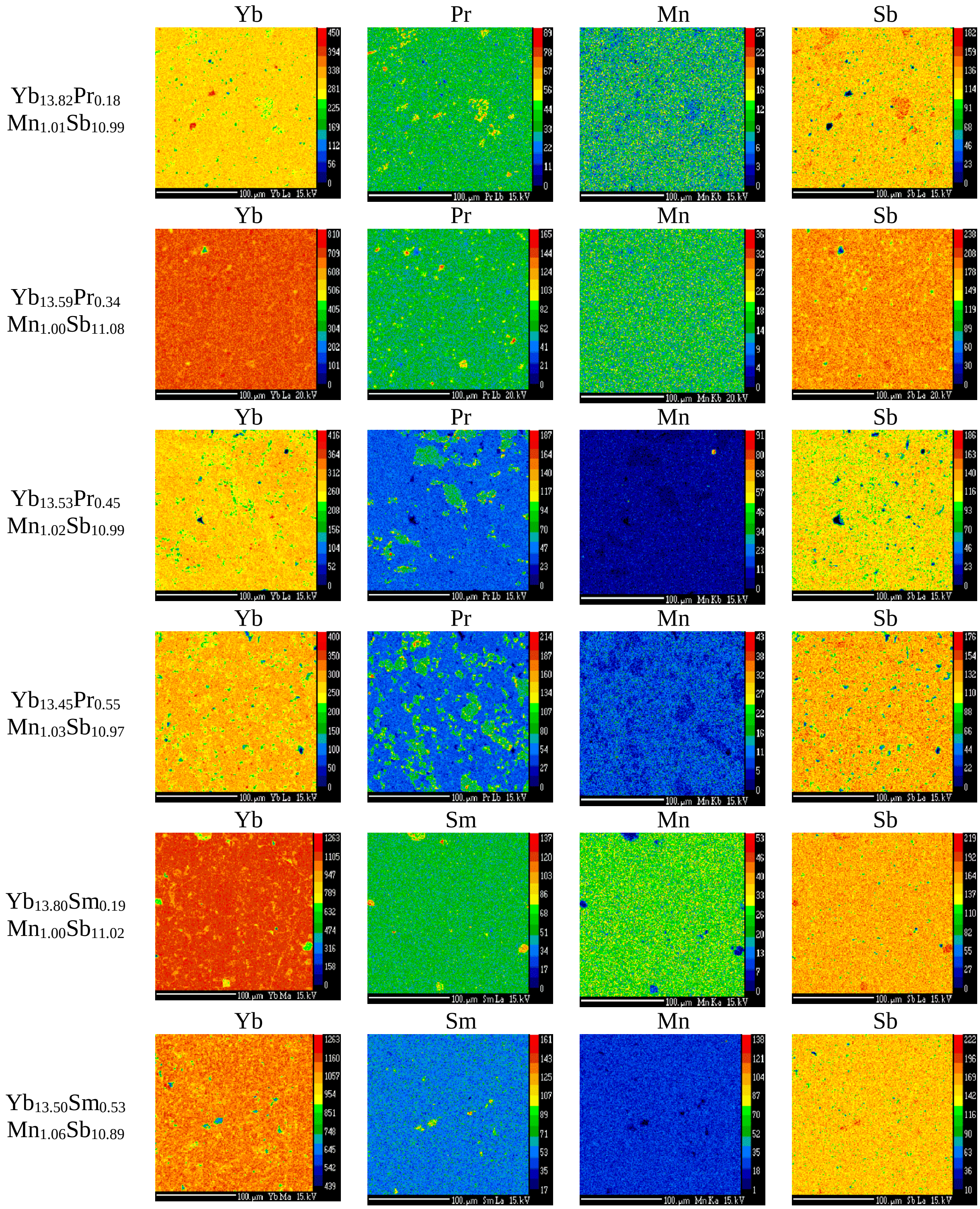
Supporting Information

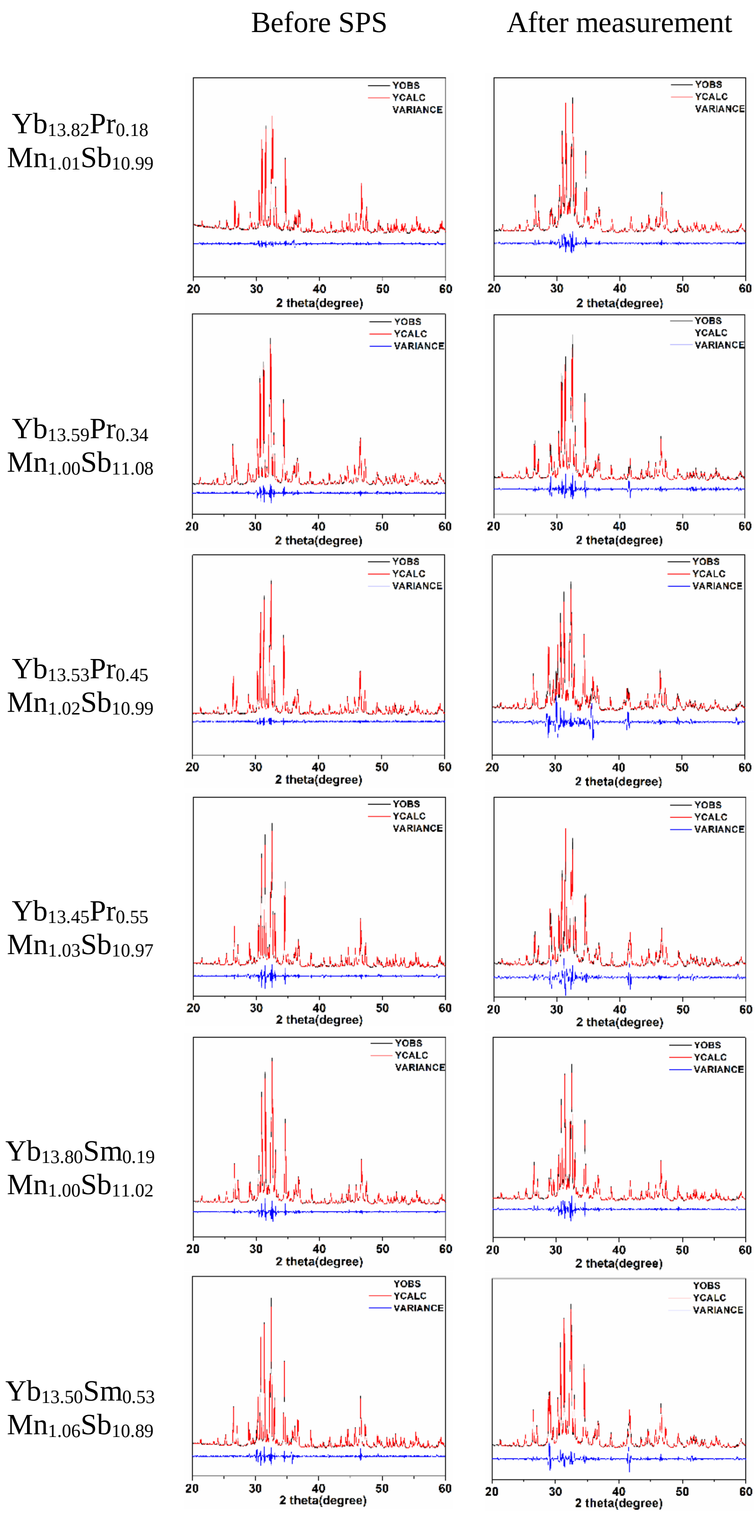
List of Tables and Figures



SFigure 1. a) and b) PXRD patterns of $Yb_{14-p}RE_pMnSb_{11}$ (*RE* = Pr and Sm, *p* = 0.2, 0.4, 0.6, 0.7, 0.8, 0.9, 1). The star in a) refers to the peaks of $(Yb,Pr)_4Sb_3$.



SFigure 2. Elemental mapping images of Sb, Yb, Mn, Pr of measured pellets. The color in the pictures corresponds to relative amount of elements according to the relative scale provided on the right side of each picture.



SFigure 3. Refined PXRD patterns of $Yb_{13.82}Pr_{0.18}Mn_{1.01}Sb_{10.99}$, $Yb_{13.59}Pr_{0.34}Mn_{1.00}Sb_{11.08}$, $Yb_{13.53}Pr_{0.45}Mn_{1.02}Sb_{10.99}$, $Yb_{13.45}Pr_{0.55}Mn_{1.03}Sb_{10.97}$, $Yb_{13.80}Sm_{0.19}Mn_{1.00}Sb_{11.02}$ and $Yb_{13.50}Sm_{0.53}Mn_{1.06}Sb_{10.89}$ before SPS after measurement. In the patterns after measurement, the variances at 29° and 41° are attributed to the existence of (Yb,*RE*)Sb and the large variances between 30° to 35° are attributed to (Yb,*RE*)$_{11}$Sb$_{10}$.

Stable 1. Heat capacity of $Yb_{13.82}Pr_{0.18}Mn_{1.01}Sb_{10.99}$, $Yb_{13.59}Pr_{0.34}Mn_{1.00}Sb_{11.08}$, $Yb_{13.53}Pr_{0.45}Mn_{1.02}Sb_{10.99}$, $Yb_{13.45}Pr_{0.55}Mn_{1.03}Sb_{10.97}$, $Yb_{13.80}Sm_{0.19}Mn_{1.00}Sb_{11.02}$ and $Yb_{13.50}Sm_{0.53}Mn_{1.06}Sb_{10.89}$.

Temperature (K)	Heat capacity (J/(g•K))	Temperature (K)	Heat capacity (J/(g•K))	Temperature (K)	Heat capacity (J/(g•K))
$Yb_{13.82}Pr_{0.18}Mn_{1.01}Sb_{10.99}$		$Yb_{13.59}Pr_{0.34}Mn_{1.00}Sb_{11.08}$		$Yb_{13.53}Pr_{0.45}Mn_{1.02}Sb_{10.99}$	
301.4	0.1812	297.9	0.1814	300.3	0.1816
374.1	0.1829	383.3	0.1834	372.8	0.1833
471.3	0.1852	478.6	0.1856	472.7	0.1857
575.2	0.1877	578.5	0.1880	573.0	0.1880
675.0	0.1900	676.3	0.1903	673.3	0.1904
775.6	0.1924	774.1	0.1926	773.3	0.1928
874.2	0.1947	872.9	0.1949	873.2	0.1951
973.6	0.1970	972.2	0.1973	972.9	0.1975
1073.6	0.1994	1072.6	0.1996	1072.7	0.1998
1173.4	0.2017	1171.3	0.2020	1172.7	0.2022
1273.4	0.2041	1272.4	0.2044	1222.7	0.2034
$Yb_{13.45}Pr_{0.55}Mn_{1.03}Sb_{10.97}$		$Yb_{13.80}Sm_{0.19}Mn_{1.00}Sb_{11.02}$		$Yb_{13.50}Sm_{0.53}Mn_{1.06}Sb_{10.89}$	
300.9	0.1818	300.1	0.1811	300.1	0.1815
374.5	0.1835	373.0	0.1828	372.8	0.1832
472.4	0.1858	472.9	0.1852	472.8	0.1855
577.9	0.1883	573.4	0.1876	572.9	0.1879
676.7	0.1906	673.4	0.1899	673.2	0.1903
775.7	0.1930	773.7	0.1923	773.3	0.1926
875.0	0.1953	873.4	0.1946	873.0	0.1950
974.3	0.1977	973.4	0.1970	973.0	0.1974
1073.9	0.2000	1073.4	0.1993	1072.9	0.1997
1173.8	0.2024	1173.4	0.2017	1172.8	0.2021
1273.7	0.2048	1273.4	0.2040	1222.8	0.2032

The molar specific heat is $C_p = 0.0898T + 663.49$ J/(mol • K). For each sample, their molar weights are used.