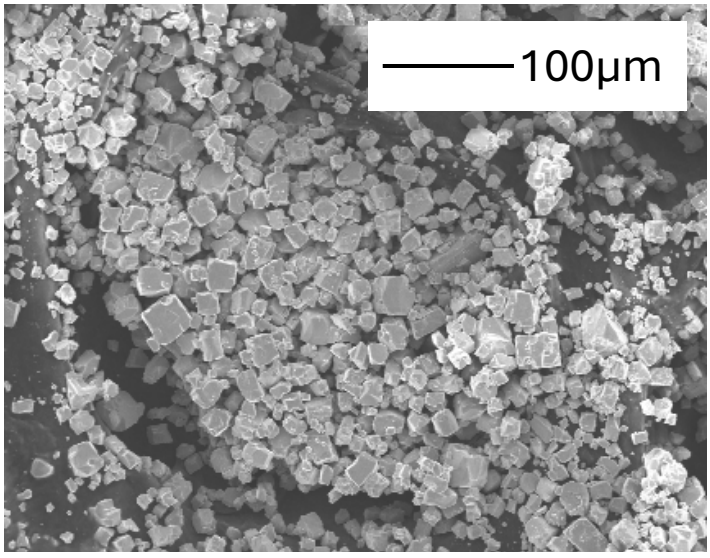


Fig. S1 SEM image of high-pressure phase (HPP) of $RbTaO_3$.

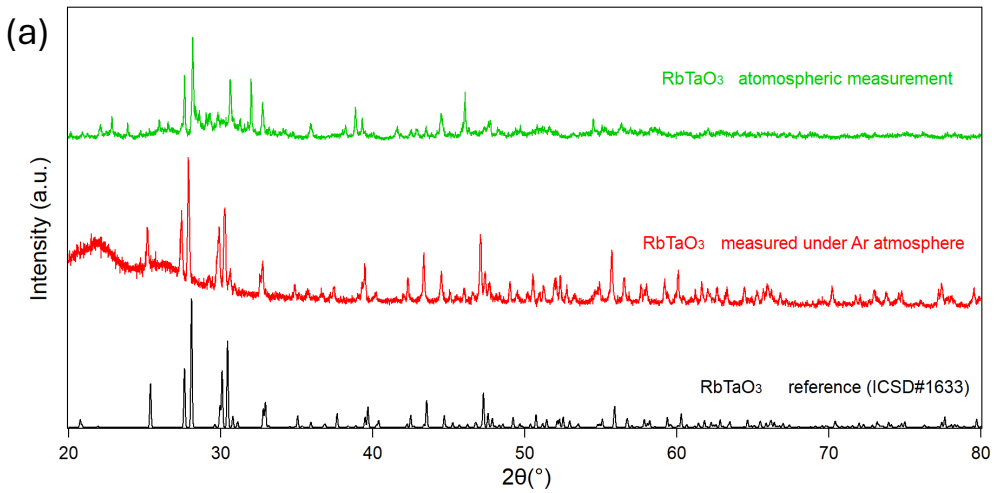


Fig. S2(a) Powder x-ray diffraction (XRD) patterns of ambient pressure phase (APP) of $RbTaO_3$, and reference. The sample under atmospheric condition absorbed H_2O from the air, thus the peak position differs from the sample measured under Ar atmosphere.

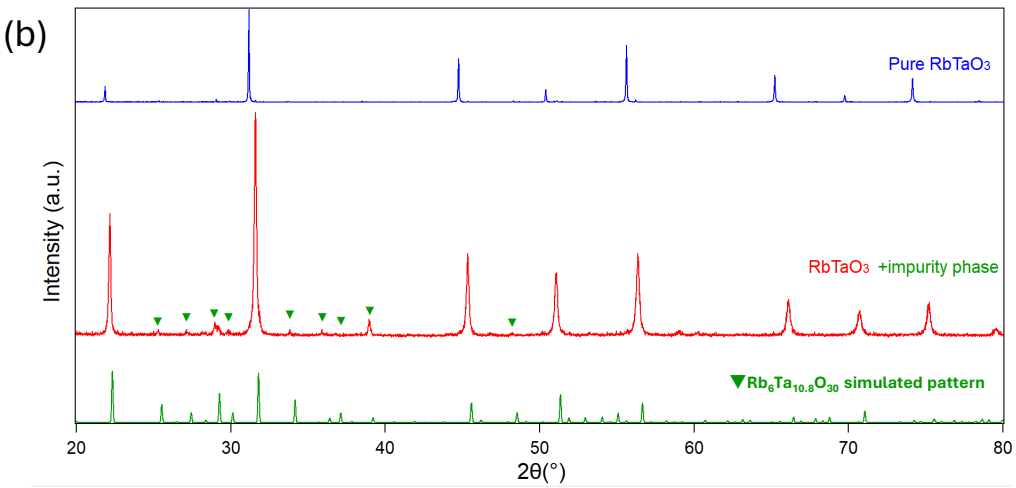
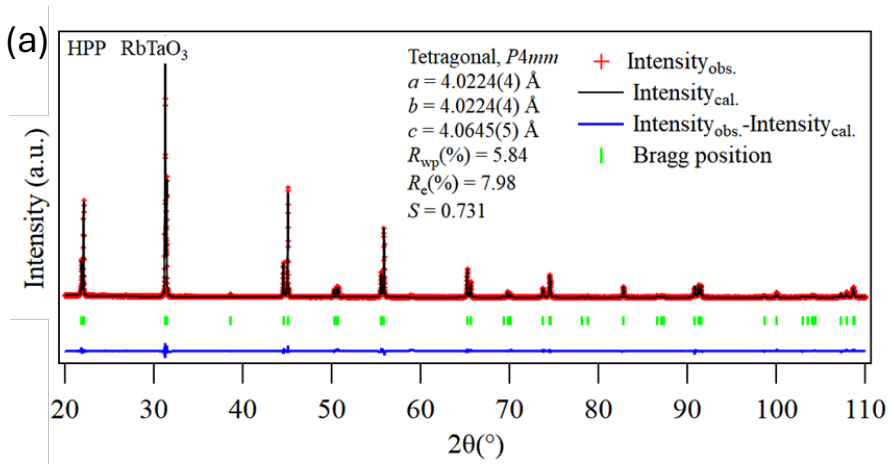
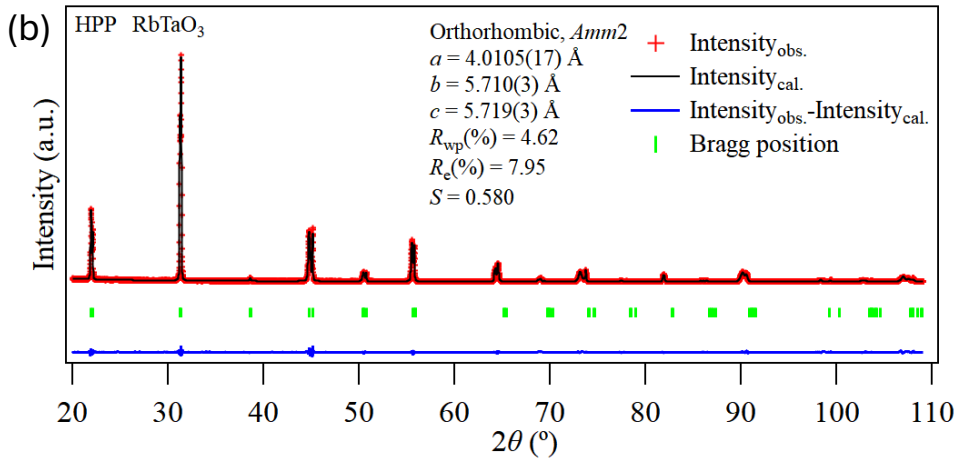


Fig. S2(b) XRD patterns of HPP of single phase of $RbTaO_3$ without and with impurity, and reference. HPP has an impurity phase, and it is thought of as the compounds that have a tetragonal tungsten bronze structure, using the APP which absorbs H_2O from the air.



Atom	Site	Occ.	x	y	z	U_{iso} (Å^2)
Rb	1*a*	1	0	0	0	0.00253
Ta	1*b*	1	1/2	1/2	0.5267(10)	0.00182
O1	1*b*	1	1/2	1/2	0.016	0.00329
O2	2*c*	1	0	1/2	0.518	0.00305

Fig. S3(a) Rietveld analysis (λ=1.540560 Å) of HPP of $RbTaO_3$ at 200 K (top: XRD patterns, bottom: refined parameters)



Atom	Site	Occ.	*x*	*y*	*z*	U_{iso} (Å^2)
Rb	2*a*	1	0	0	0	0.00253
Ta	2*b*	1	1/2	0	0.5183(12)	0.00182
O1	2*a*	1	0	0	0.348(10)	0.00329
O2	4*e*	1	1/2	0.2659	0.261(9)	0.00303

Fig. S3(b) Rietveld analysis (λ=1.540560 Å) of HPP of $RbTaO_3$ at 10 K (top: XRD patterns, bottom: refined parameters)

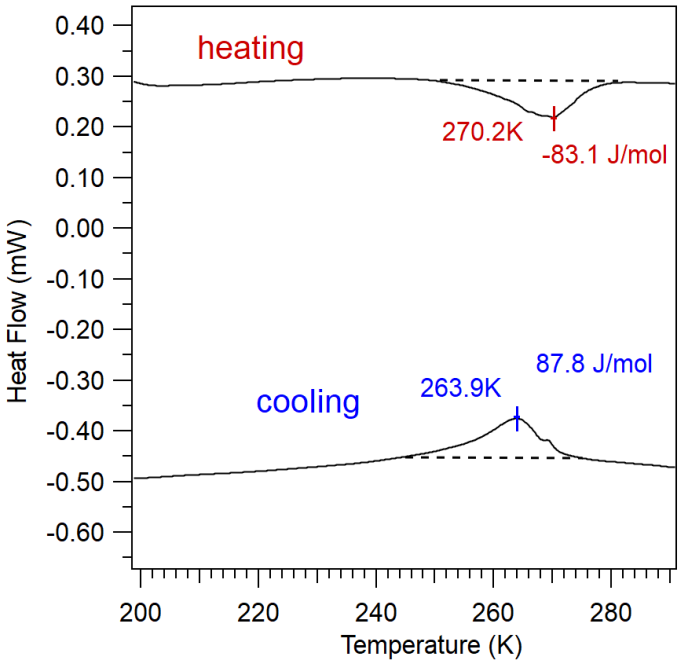


Fig. S4 Thermal analysis of Differential Scanning Calorimetry (DSC). Transition temperature was 263.9 K in cooling and 270.2 K in heating. the enthalpy changes with the phase transitions are 163 J mol^{-1} in cooling and -76.4 J mol^{-1} in heating.