Supplementary Information

Longitudinal zero thermal expansion in Re-Fe (R = Tb, Er) eutectic alloys with high fracture resistance

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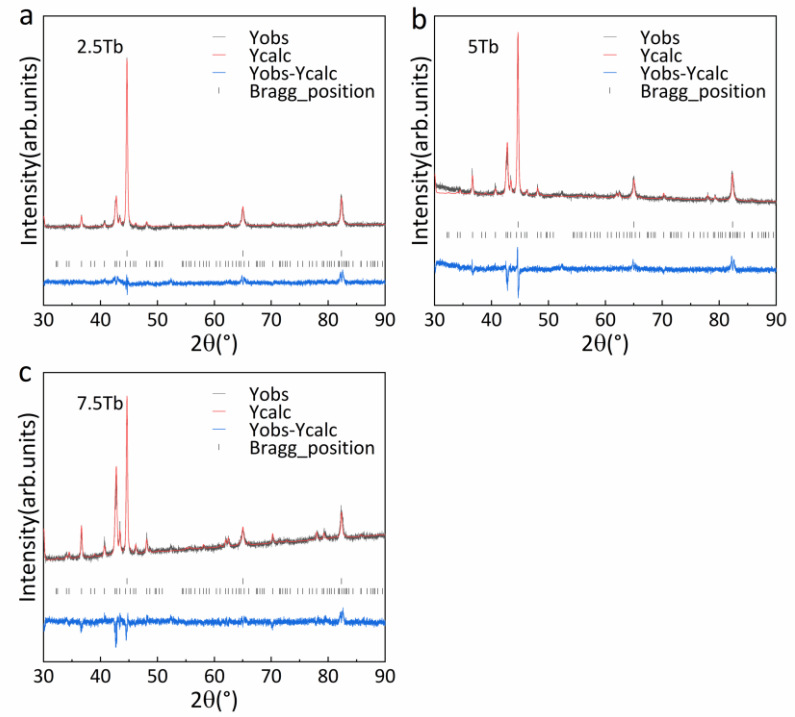


Fig. S1 The full-profile fitting patterns for 2.5Tb (a), 5Tb (b)and 7.5Tb(c).

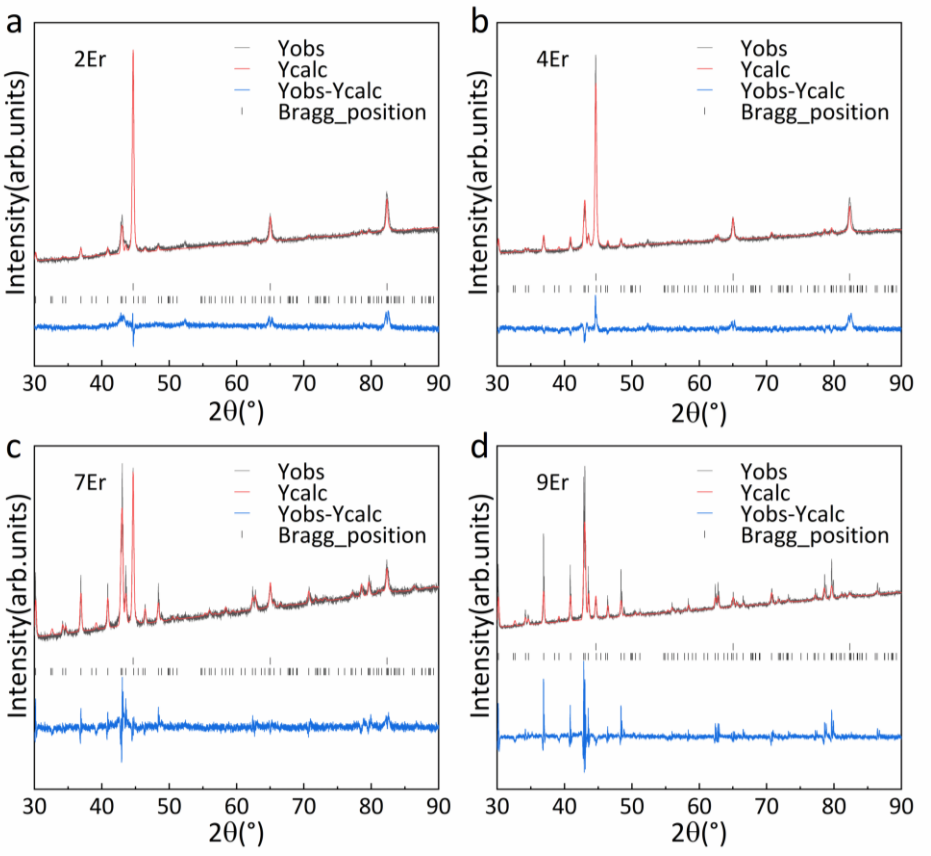


Fig. S2 The full-profile fitting patterns for 2Er (a), 4Er (b), 7Er(c) and 9Er(d).

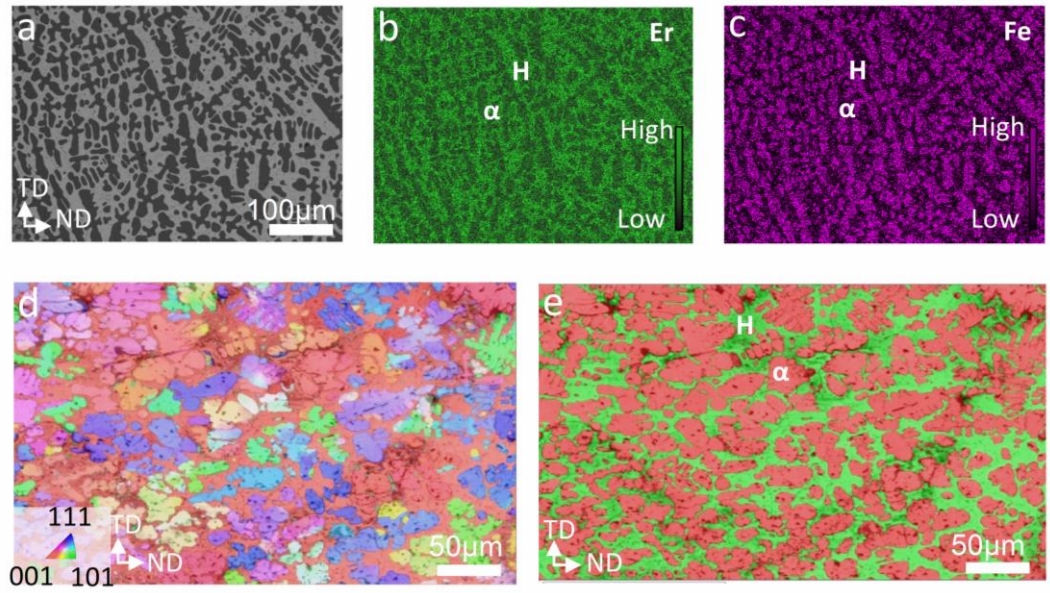


Fig. S3 (a) The morphology of 4Er alloy measured by SEM in the TD (transverse direction) - ND (normal direction) plane. (b-c) Element mappings of Er (b) and Fe (c) corresponding to the region shown in (a). (d-e) EBSD inverse pole figure and phase figure for 4Er alloy in the TD-ND plane.

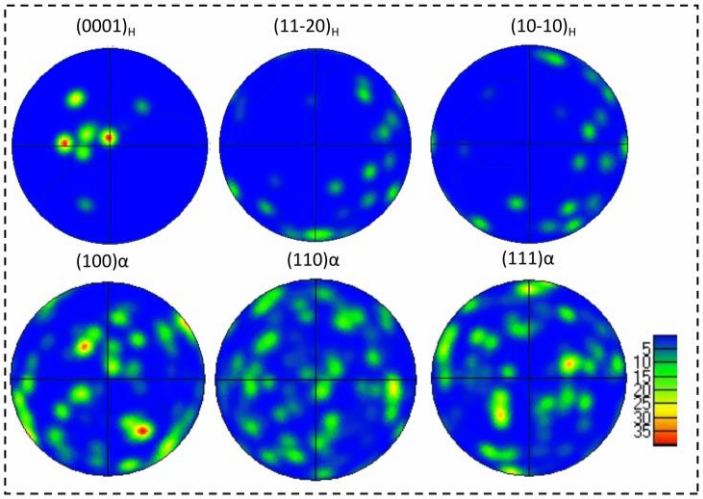


Fig. S4 Electron back-scattered diffraction (EBSD) pole figures of the $(0001)_H$, $(11\text{-}20)_H$, $(10\text{-}10)_H$, $(100)_\alpha$, $(110)_\alpha$ and $(111)_\alpha$ directions for bulk 5Tb alloy.

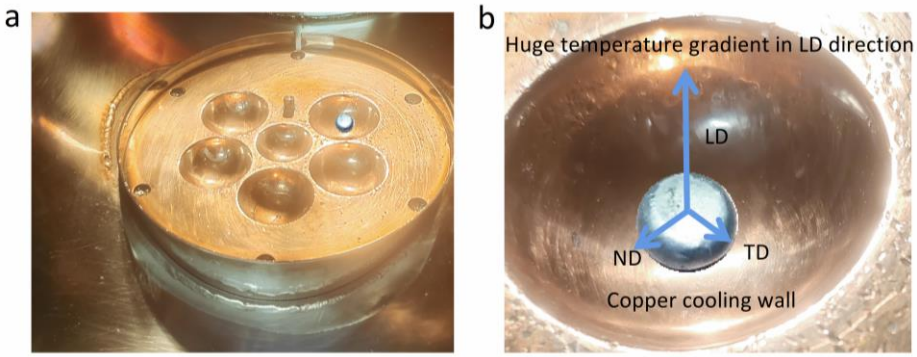


Fig. S5 Pictures showing huge temperature gradient from the melt to the copper cooling wall during the crystallization of bulk materials in electric arc furnace.

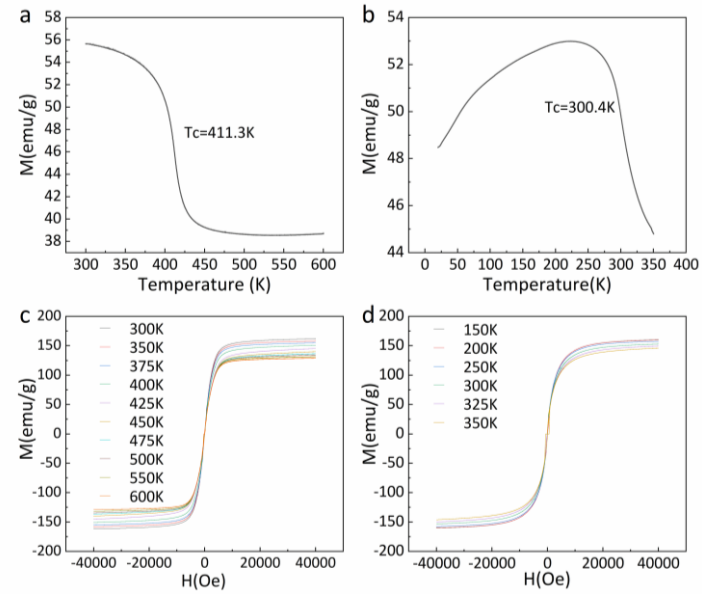
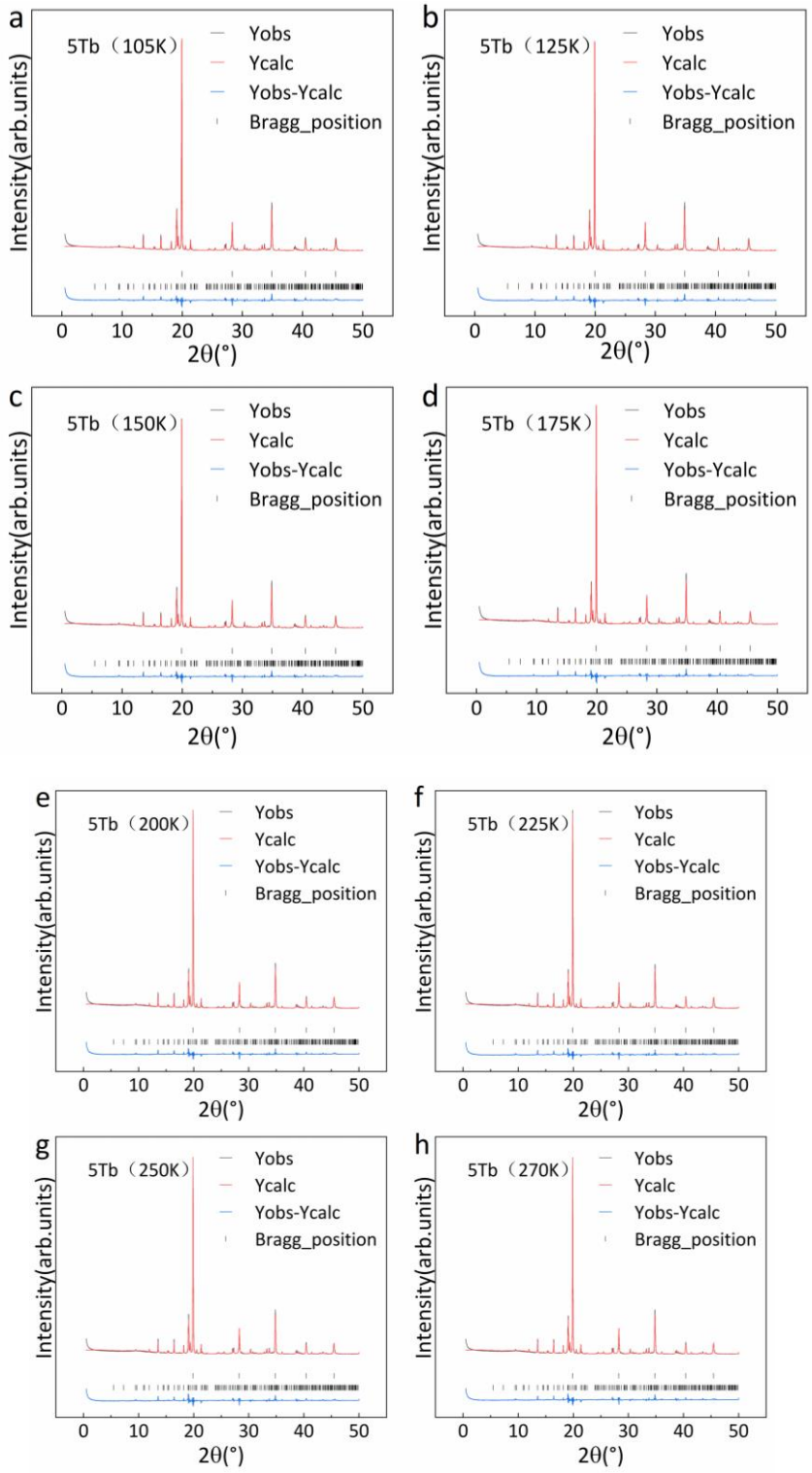
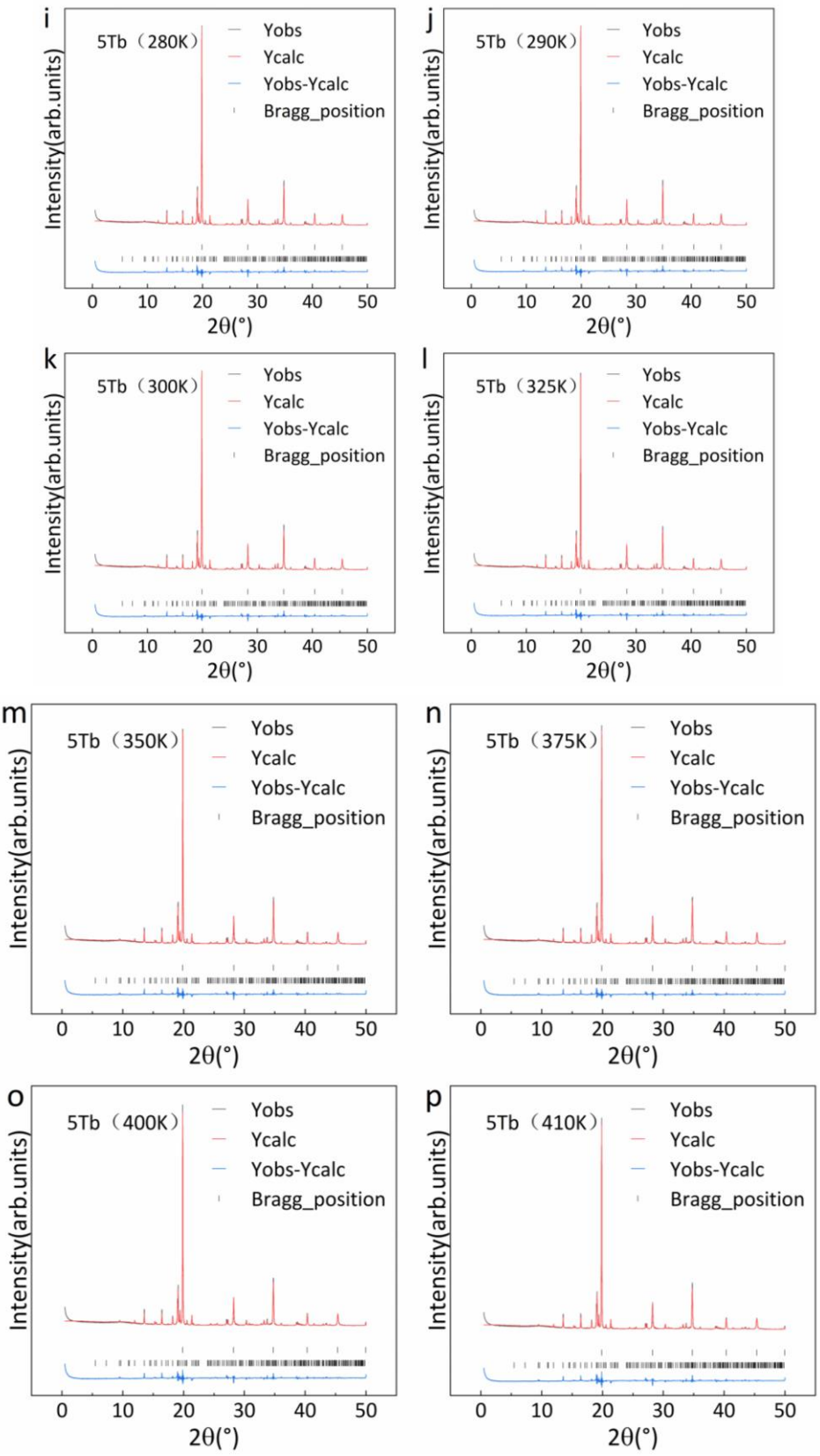


Fig. S6 (a-b) The thermomagnetic curves of the 5Tb(a) and 4Er(b) alloys under a magnetic field of 1000 Oe. (c-d) Temperature dependence of magnetic hysteresis loop of the 5Tb (c) and 4Er (d) alloys.


a
5Tb（105K）
Yobs
Ycalc
Yobs-Ycalc
Bragg_position
Intensity(arb.units)
2θ(°)
b
5Tb（125K）
c
5Tb（150K）
d
5Tb（175K）
e
5Tb（200K）
f
5Tb（225K）
g
5Tb（250K）
h
5Tb（270K）


i
5Tb（280K）
j
5Tb（290K）
k
5Tb（300K）
l
5Tb（325K）
m
5Tb（350K）
n
5Tb（375K）
o
5Tb（400K）
p
5Tb（410K）
Yobs
Ycalc
Yobs-Ycalc
Bragg_position
Intensity(arb.units)
2θ(°)
0
10
20
30
40
50

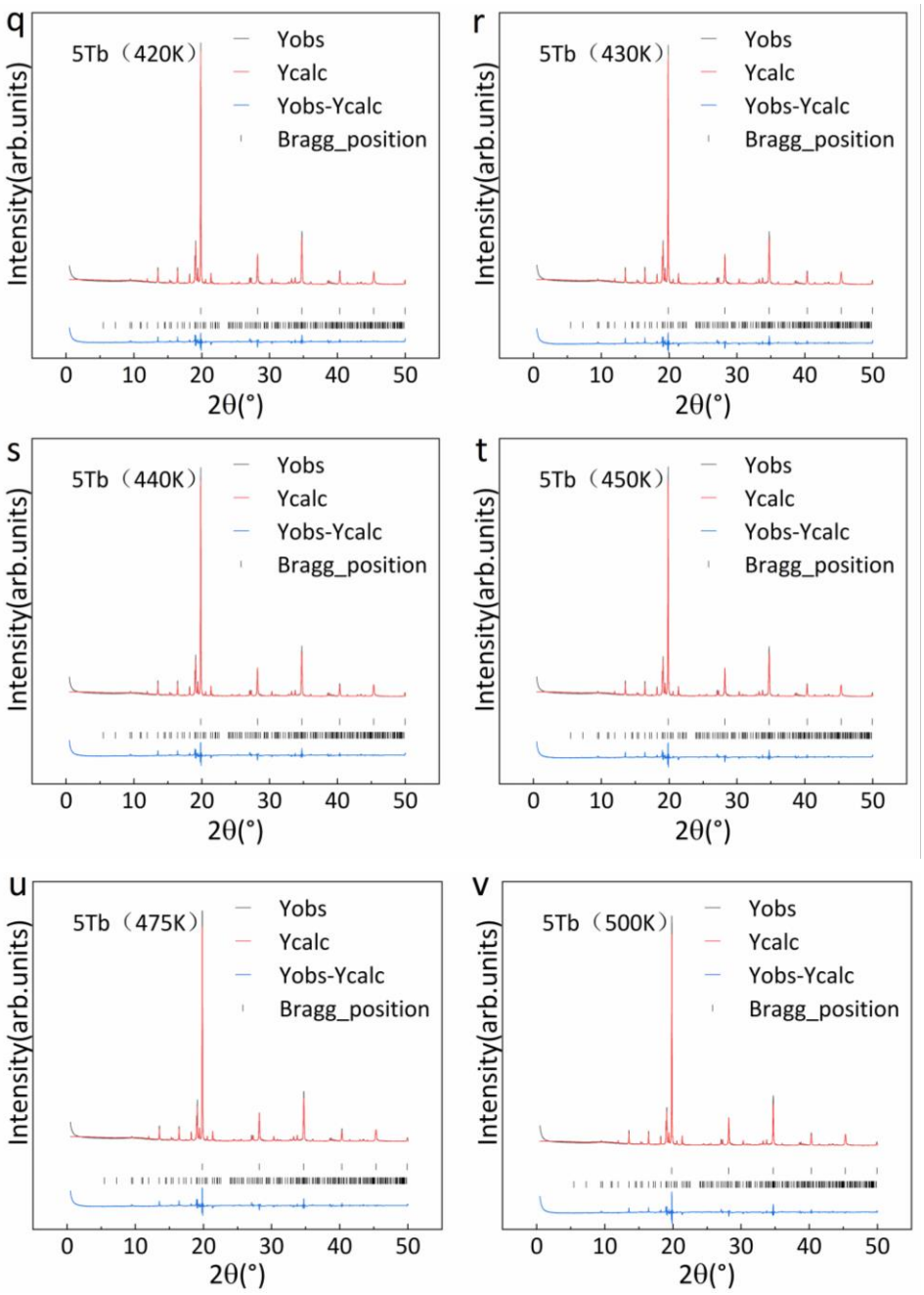


Fig. S7 The full-profile fitting patterns for 5Tb at different temperatures using synchrotron X-ray diffraction data.

Table. S1 Lattice constants of 5Tb alloy refined from variable temperature synchrotron X-ray diffraction.

T(K)	***a*(α)**	***a*(H)**	***c*(H)**
105	2.8612(1)	8.4710(4)	8.3408(3)
125	2.8617(1)	8.4719(4)	8.3384(3)
150	2.8622(1)	8.4733(4)	8.3363(3)
175	2.8628(1)	8.4744(4)	8.3342(3)
200	2.8634(1)	8.4757(5)	8.3323(3)
225	2.8642(1)	8.4768(5)	8.3304(3)
250	2.8649(1)	8.4781(5)	8.3287(3)
270	2.8656(1)	8.4788(5)	8.3267(3)
280	2.8659(1)	8.4792(5)	8.3257(3)
290	2.8663(1)	8.4797(4)	8.3255(3)
300	2.8666(1)	8.4799(4)	8.3249(3)
325	2.8675(1)	8.4805(4)	8.3225(3)
350	2.8683(1)	8.4808(5)	8.3201(3)
375	2.8692(1)	8.4809(5)	8.3175(3)
400	2.8700(1)	8.4809(5)	8.3147(3)
410	2.8704(1)	8.4806(5)	8.3134(3)
420	2.8708(1)	8.4805(4)	8.3121(3)
430	2.8712(1)	8.4807(5)	8.3116(3)
440	2.8716(1)	8.4813(5)	8.3114(3)
450	2.8720(1)	8.4819(5)	8.3115(3)
475	2.8729(1)	8.4835(5)	8.3121(3)
500	2.8740(1)	8.4852(5)	8.3127(3)