TABLE S1

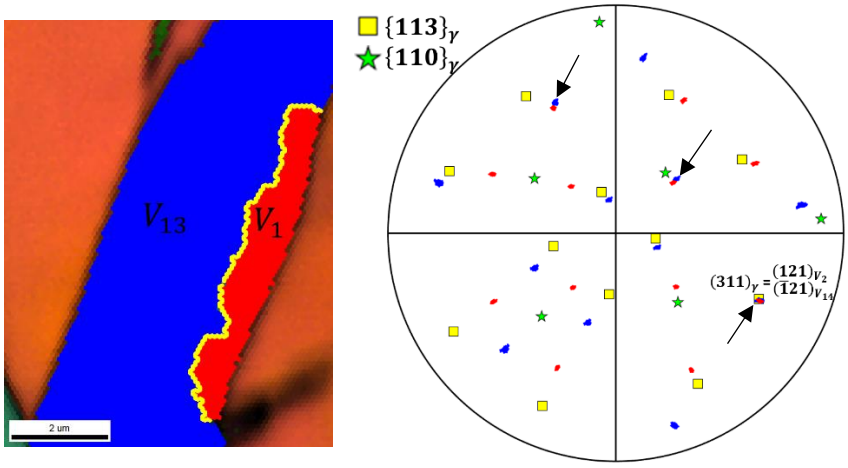
Variant classification, Habit plane (HP), Shape deformation direction (SD), magnitude of shear (m) for solutions 1 and 3 of the PTMC with a LIS by slip $\{113\}_\gamma\langle 110\rangle_\gamma$.
(for Solution 1: h=0.82193,k=0.44004,l=0.36165;u=0.838,v=0.39001,w=0.38165 and m=0.36)
(for Solution 3: h=0.823,k=0.40899,l=0.3942;u=0.75246,v=0.65314,w=0.08488 and m=1.66)

CV	Variant Number	Closest KS variant	LIS	HP s1,s3	SD s1	SD s3
CV1 $\begin{bmatrix}0&1&\bar{1}\\0&1&1\\1&0&0\end{bmatrix}$	V_{18}	$(\bar{1}\bar{1}1)_\gamma//(\bar{1}10)_\alpha$ $[\bar{1}10]_\gamma//[11\bar{1}]_\alpha$	$(113)_\gamma[\bar{1}10]_\gamma$ $(11\bar{3})_\gamma[\bar{1}10]_\gamma$	$(\bar{k}lh)_\gamma$	$(u\bar{w}v)_\gamma$	$(u\bar{v}w)_\gamma$
	V_{15}	$(111)_\gamma//(\bar{1}10)_\alpha$ $[\bar{1}10]_\gamma//[[\bar{1}\bar{1}1]]_\alpha$	$(11\bar{3})_\gamma[\bar{1}10]_\gamma$ $(113)_\gamma[\bar{1}10]_\gamma$	$(\overline{klh})_\gamma$	$(u\overline{w\bar{v}})_\gamma$	$(u\overline{\bar{v}w})_\gamma$
	V_{24}	$(1\bar{1}1)_\gamma//(\bar{1}\bar{1}0)_\alpha$ $[\bar{1}\bar{1}0]_\gamma//[\bar{1}1\bar{1}]_\alpha$	$(\bar{1}13)_\gamma[110]_\gamma$ $(\bar{1}1\bar{3})_\gamma[110]_\gamma$	$(k\bar{l}h)_\gamma$	$(\overline{u\bar{w}}v)_\gamma$	$(\overline{u\bar{v}}w)_\gamma$
	V_{21}	$(\bar{1}11)_\gamma//(110)_\alpha$ $[110]_\gamma//[1\bar{1}\bar{1}]_\alpha$	$(\bar{1}1\bar{3})_\gamma[110]_\gamma$ $(\bar{1}13)_\gamma[110]_\gamma$	$(k\overline{\bar{l}h})_\gamma$	$(\overline{u\bar{w}\bar{v}})_\gamma$	$(\overline{u\bar{v}\bar{w}})_\gamma$
	V_{11}	$(1\bar{1}1)_\gamma//(\bar{1}01)_\alpha$ $[\bar{1}01]_\gamma//[\bar{1}1\bar{1}]_\alpha$	$(131)_\gamma[\bar{1}01]_\gamma$ $(13\bar{1})_\gamma[\bar{1}01]_\gamma$	$(\bar{k}h\bar{l})_\gamma$	$(uv\bar{w})_\gamma$	$(uw\bar{v})_\gamma$
	V_2	$(111)_\gamma//(\bar{1}01)_\alpha$ $[\bar{1}01]_\gamma//[\bar{1}\bar{1}\bar{1}]_\alpha$	$(13\bar{1})_\gamma[\bar{1}01]_\gamma$ $(131)_\gamma[\bar{1}01]_\gamma$	$(\overline{khl})_\gamma$	$(u\overline{v\bar{w}})_\gamma$	$(u\overline{w\bar{v}})_\gamma$
	V_8	$(\bar{1}11)_\gamma//(101)_\alpha$ $[101]_\gamma//[1\bar{1}\bar{1}]_\alpha$	$(13\bar{1})_\gamma[101]_\gamma$ $(1\bar{3}\bar{1})_\gamma[101]_\gamma$	$(\bar{k}hl)_\gamma$	$(uvw)_\gamma$	$(uwv)_\gamma$
	V_5	$(\bar{1}\bar{1}1)_\gamma//(101)_\alpha$ $[101]_\gamma//[11\bar{1}]_\alpha$	$(1\bar{3}\bar{1})_\gamma[101]_\gamma$ $(13\bar{1})_\gamma[101]_\gamma$	$(\overline{k\bar{h}l})_\gamma$	$(u\bar{v}w)_\gamma$	$(u\bar{w}v)_\gamma$
CV2 $\begin{bmatrix}1&0&1\\1&0&\bar{1}\\0&1&0\end{bmatrix}$	V_6	$(\bar{1}\bar{1}1)_\gamma//(\bar{1}10)_\alpha$ $[\bar{1}10]_\gamma//[11\bar{1}]_\alpha$	$(113)_\gamma[\bar{1}10]_\gamma$ $(11\bar{3})_\gamma[\bar{1}10]_\gamma$	$(\bar{l}\bar{k}h)_\gamma$	$(\bar{w}uv)_\gamma$	$(\bar{v}uw)_\gamma$
	V_3	$(111)_\gamma//(1\bar{1}0)_\alpha$ $[1\bar{1}0]_\gamma//[[\bar{1}\bar{1}\bar{1}]]_\alpha$	$(11\bar{3})_\gamma[\bar{1}10]_\gamma$ $(113)_\gamma[\bar{1}10]_\gamma$	$(\overline{lkh})_\gamma$	$(\bar{w}u\bar{v})_\gamma$	$(\bar{v}u\bar{w})_\gamma$
	V_{12}	$(1\bar{1}1)_\gamma//(110)_\alpha$ $[110]_\gamma//[\bar{1}1\bar{1}]_\alpha$	$(\bar{1}13)_\gamma[110]_\gamma$ $(\bar{1}1\bar{3})_\gamma[110]_\gamma$	$(l\bar{k}h)_\gamma$	$(wuv)_\gamma$	$(vuw)_\gamma$
	V_9	$(\bar{1}11)_\gamma//(\bar{1}\bar{1}0)_\alpha$ $[\bar{1}\bar{1}0]_\gamma//[1\bar{1}\bar{1}]_\alpha$	$(\bar{1}1\bar{3})_\gamma[110]_\gamma$ $(\bar{1}13)_\gamma[110]_\gamma$	$(\overline{l\bar{k}h})_\gamma$	$(wu\bar{v})_\gamma$	$(vu\bar{w})_\gamma$
	V_{19}	$(\bar{1}11)_\gamma//(0\bar{1}1)_\alpha$ $[0\bar{1}1]_\gamma//[1\bar{1}\bar{1}]_\alpha$	$(311)_\gamma[0\bar{1}1]_\gamma$ $(\bar{3}11)_\gamma[0\bar{1}1]_\gamma$	$(h\bar{k}\bar{l})_\gamma$	$(vu\bar{w})_\gamma$	$(wu\bar{v})_\gamma$
	V_{13}	$(111)_\gamma//(0\bar{1}1)_\alpha$ $[0\bar{1}1]_\gamma//[[\bar{1}\bar{1}\bar{1}]]_\alpha$	$(\bar{3}11)_\gamma[0\bar{1}1]_\gamma$ $(311)_\gamma[0\bar{1}1]_\gamma$	$(\overline{h\bar{k}l})_\gamma$	$(\bar{v}u\bar{w})_\gamma$	$(\bar{w}u\bar{v})_\gamma$
	V_{16}	$(\bar{1}\bar{1}1)_\gamma//(011)_\alpha$ $[011]_\gamma//[11\bar{1}]_\alpha$	$(3\bar{1}1)_\gamma[011]_\gamma$ $(\bar{3}\bar{1}1)_\gamma[011]_\gamma$	$(hk\bar{l})_\gamma$	$(v\bar{u}\bar{w})_\gamma$	$(w\bar{u}\bar{v})_\gamma$
	V_{22}	$(1\bar{1}1)_\gamma//(011)_\alpha$ $[011]_\gamma//[\bar{1}1\bar{1}]_\alpha$	$(\bar{3}\bar{1}1)_\gamma[011]_\gamma$ $(3\bar{1}1)_\gamma[011]_\gamma$	$(\bar{h}k\bar{l})_\gamma$	$(\overline{v\bar{u}w})_\gamma$	$(\overline{w\bar{u}v})_\gamma$
CV3 $\begin{bmatrix}1&\bar{1}&0\\1&1&0\\0&0&1\end{bmatrix}$	V_{23}	$(1\bar{1}1)_\gamma//(10\bar{1})_\alpha$ $[10\bar{1}]_\gamma//[\bar{1}1\bar{1}]_\alpha$	$(131)_\gamma[10\bar{1}]_\gamma$ $(1\bar{3}1)_\gamma[10\bar{1}]_\gamma$	$(\bar{l}h\bar{k})_\gamma$	$(\bar{w}vu)_\gamma$	$(\bar{v}wu)_\gamma$
	V_{14}	$(111)_\gamma//(10\bar{1})_\alpha$ $[10\bar{1}]_\gamma//[[\bar{1}\bar{1}\bar{1}]]_\alpha$	$(1\bar{3}1)_\gamma[10\bar{1}]_\gamma$ $(131)_\gamma[10\bar{1}]_\gamma$	$(\overline{lhk})_\gamma$	$(\overline{w\bar{v}}u)_\gamma$	$(\overline{v\bar{w}}u)_\gamma$
	V_{20}	$(\bar{1}11)_\gamma//(\bar{1}0\bar{1})_\alpha$ $[\bar{1}0\bar{1}]_\gamma//[1\bar{1}\bar{1}]_\alpha$	$(13\bar{1})_\gamma[101]_\gamma$ $(1\bar{3}\bar{1})_\gamma[101]_\gamma$	$(\bar{l}hk)_\gamma$	$(\bar{w}v\bar{u})_\gamma$	$(\bar{v}w\bar{u})_\gamma$
	V_{17}	$(\bar{1}\bar{1}1)_\gamma//(\bar{1}0\bar{1})_\alpha$ $[\bar{1}0\bar{1}]_\gamma//[11\bar{1}]_\alpha$	$(1\bar{3}\bar{1})_\gamma[101]_\gamma$ $(13\bar{1})_\gamma[101]_\gamma$	$(\overline{\bar{l}hk})_\gamma$	$(\overline{w\bar{v}u})_\gamma$	$(\overline{\bar{v}wu})_\gamma$

	V_7	$(\bar{1}11)_\gamma // (01\bar{1})_\alpha$ $[01\bar{1}]_\gamma // [1\bar{1}\bar{1}]_\alpha$	$(311)_\gamma[01\bar{1}]_\gamma$ $(\bar{3}11)_\gamma[01\bar{1}]_\gamma$	$(h\bar{l}\bar{k})_\gamma$	$(v\bar{w}u)_\gamma$	$(w\bar{v}u)_\gamma$
	V_1	$(111)_\gamma // (01\bar{1})_\alpha$ $[01\bar{1}]_\gamma // [[\bar{1}\bar{1}\bar{1}]]_\alpha$	$(\bar{3}11)_\gamma[01\bar{1}]_\gamma$ $(311)_\gamma[01\bar{1}]_\gamma$	$(\bar{h}\bar{l}\bar{k})_\gamma$	$(\bar{v}\bar{w}u)_\gamma$	$(\bar{w}\bar{v}u)_\gamma$
	V_4	$(\bar{1}\bar{1}1)_\gamma // (0\bar{1}\bar{1})_\alpha$ $[0\bar{1}\bar{1}]_\gamma // [11\bar{1}]_\alpha$	$(3\bar{1}1)_\gamma[011]_\gamma$ $(\bar{3}\bar{1}1)_\gamma[011]_\gamma$	$(h\bar{l}\bar{k})_\gamma$	$(vwu)_\gamma$	$(wvu)_\gamma$
	V_{10}	$(1\bar{1}1)_\gamma // (0\bar{1}\bar{1})_\alpha$ $[0\bar{1}\bar{1}]_\gamma // [\bar{1}1\bar{1}]_\alpha$	$(\bar{3}\bar{1}1)_\gamma[011]_\gamma$ $(3\bar{1}1)_\gamma[011]_\gamma$	$(\bar{h}l\bar{k})_\gamma$	$(\bar{v}wu)_\gamma$	$(\bar{w}vu)_\gamma$

FIGURE S1

Figure S1a shows the IQ + IPF map of the area enclosed in area 2 in Figure 1a. Martensite pixels inside the matrix and twinned area are highlighted in blue and red, respectively. Misorientation calculations show that the twinned area is within 1° from the variant V_1 of the ORs of solution 1 and 3, respectively. Similar calculations show that the matrix area is within 1.5° from the variant V_{13} of the same ORs. Referring to TABLE S1, if V_1 corresponds to solution 1, its correspondence variant (CV) is CV3 and its associated LIS is on $(\bar{3}11)_\gamma[0\bar{1}1]_\gamma$ while if it corresponds to solution 3, it has the same CV3 but a different LIS on $(311)_\gamma[0\bar{1}1]_\gamma$. According to CV3, the $(\bar{3}11)_\gamma$ and $(311)_\gamma$ planes originate from $(\bar{2}\bar{1}1)_\alpha$ and $(121)_\alpha$, respectively. Similarly, if V_{13} corresponds to solution 1, it comes from CV2 and its LIS is on $(\bar{3}11)_\gamma[0\bar{1}1]_\gamma$, while if it corresponds to solution 3, it has the same CV3 but a different LIS on $(311)_\gamma[0\bar{1}1]_\gamma$. According to CV3, the $(\bar{3}11)_\gamma$ and $(311)_\gamma$ planes originate from $(\bar{1}\bar{2}1)_\alpha$ and $(211)_\alpha$, respectively. It is then a priori possible to distinguish between solution 1 and 3 by measuring the relative orientation of the $(311)_\gamma$ and $(\bar{3}11)_\gamma$ planes with respect to the $\{112\}_\alpha$ poles of variants V_1 and V_{13}.



a b

Figure S1. a) IQ + IPF map of area 2 in Figure 1a. The matrix and twin orientations are highlighted in blue and red, respectively, b) $\{112\}_\alpha$ pole figure of variants V_1 (red points) and V_{13} (blue points) in Figure S1.a together with the $\{110\}_\gamma$ and $\{113\}_\gamma$ of the parent austenite.

Figure S1b is the experimental $\{112\}_\alpha$ pole figure of variants V_1 (red points) and V_{13} (blue points) shown in Figure S1a. Three $\{112\}_\alpha$ poles are in common between the two variants, as expected for twin related crystals on the $\{112\}_\alpha\langle 111\rangle_\alpha$ system. These poles are indicated by black arrows in Figure S1b. The $\{110\}_\gamma$ and $\{113\}_\gamma$ pole figures of the parent austenite are superimposed as yellow squares

and green stars, respectively. It can be seen that none of the $\{110\}_\gamma$ poles are parallel to any of the three common $\{112\}_\alpha$ poles. This tends to confirm that the LIS of $\{225\}_\gamma$ martensite does not correspond to a $\{110\}_\gamma\langle 110\rangle_\gamma$ system. On the contrary, the $(311)_\gamma$ pole is strictly parallel to the common poles $(121)_{V_2}/(\bar{1}21)_{\boldsymbol{V_{14}}}$. Hence, a complete agreement with the experiments is obtained when considering that V_1 and V_{13} are variants of the solution 3 of the PTMC with a LIS on $(311)_\gamma[0\bar{1}1]_\gamma$.