

附錄 反應列表

M:主產物；m:副產物

編號	反應比例	升溫條件	結果(依據粉末繞射圖比對結果)
1	GaSe	950°C 2hr	Ga ₂ Se ₃ (M) , GaSe(m)
2	GaTe	950°C 2hr	GaTe(M)
4	Ga ₂ Se ₃	780°C 6hr	Ga ₂ Se ₃ (M)
5	Ga ₂ Se ₃	830°C 12hr	Ga ₂ Se ₃ (M)
6	Ga ₂ Se ₃	1025°C 12hr	Ga ₂ Se ₃ (M)
7	SrGa ₂ Se ₄	830°C 12hr	SrGa ₂ Se ₄ (M) , SrSe(m) , GaSe(m)
8	SrGa ₂ Te ₄	830°C 12hr	SrGa ₂ Te ₄ (M) , Ga ₂ Te ₅ (m) , Te(m)
9	BaGa ₂ Se ₄	830°C 12hr	BaGa ₂ Se ₄ (M) , GaSe(m) , Se ₈ (m)
10	BaGa ₂ Te ₄	830°C 12hr	BaGa ₂ Te ₄ (M) , BaTe(m)
11	TiGa ₂ Te ₄	900 °C 6hr	Ga ₂ Se ₃ (M) , GaSe(m) , Ti ₅ Se ₈ (m)
12	VGa ₂ Te ₄	900 °C 6hr	Ga ₂ Se ₃ (M) , GaSe(m) , VOSeO ₃ (m)
13	ZrGa ₂ Te ₄	900 °C 6hr	Ga ₂ Se ₃ (M) , GaSe(m) , ZrO ₂ (m)
14	NbGa ₂ Te ₄	900 °C 6hr	Ga ₂ Se ₃ (M) , GaSe(m)
15	HfGa ₂ Te ₄	900 °C 6hr	Ga ₂ Se ₃ (M) , GaSe(m)
16	NbGa ₂ Te ₄	900 °C 6hr	Ga ₂ Se ₃ (M) , TaSe ₂ (m)
17	TiGaSe	850 °C 6hr	GaSe(M)
18	VGaSe	850 °C 6hr	GaSe(M) , V ₃ Se ₄ (m)
19	ZrGaSe	850 °C 6hr	GaSe(M) , Zr(m) , ZrO ₃ (m)
20	NbGaSe	850 °C 6hr	GaSe(M) , Nb(m)
21	HfGaSe	850 °C 6hr	GaSe(M) , Hf(m)
22	TaGaSe	850 °C 6hr	GaSe(M) , Ta(m)
23	GaSb	870 °C 6hr	GaSb(M) , Sb(m)
24	GaSbSe	800 °C 24hr	GaSb(M) , GaSe(m)
25	LaGaSe ₃	960 °C 24hr	LaSe _{1.9} (M) , Ga ₂ Se ₃ (m)
26	La ₄ Ga ₅ Se ₁₃	960 °C 24hr	Ga ₂ Se ₃ (M) , La(GaO ₃) (m)
27	La ₃ GaSe ₆	960 °C 24hr	LaSe(M) , LaSe _{1.9} (m)
28	SrGa ₂ Sb ₂	900 °C 24hr	Sr ₃ GaSb ₃ (M) , GaSb(m)
29	Sr ₃ Ga ₄ Sb ₅	900 °C 24hr	Sr ₃ GaSb ₃ (M) , GaSb(m) , Sb ₃ Sr ₂ (m)
30	La ₆ GaInSe ₁₂	960 °C 6hr	LaSe _{1.9} (M) , unknown(m)
31	La ₄ Ga ₂ In ₃ Se ₁₃	960 °C 6hr	Ga ₃ La ₅ (M) , Ga ₂ Se ₃ (m)
32	La ₆ GaInSe ₁₂ + I ₂	950 °C 12.5hr	La ₃ Se ₄ (M) , GaSe(m)
33	La ₆ Ga ₁₀ InSe ₁₂	950 °C 12.5hr	GaSe(M)
34	LaGa ₂ Hf	925 °C 10h	Ga ₅ La ₂ (M) , GaHf ₂ (m)
35	La ₂ Ga ₃ Hf	950°C 10h	Ga ₃ La(M) , GaHf ₂ (m)

36	LaGa ₃ Hf ₂	950 °C 10h	Ga ₃ La(M) , GaHf ₂ (m)
37	LaGa ₃ Zr ₂	950 °C 10h	Ga ₅ La ₂ (M) , GaZr ₂ (m)
38	La ₆ GaInSe ₁₂ + NaCl	920 °C to 500 °C 120h	LaSe ₂ (M), In ₆ Se ₇ (m), unknown(m)
39	La ₄ Ga ₂ In ₃ Se ₁₃ + NaCl	920 °C to 500 °C 120h	La ₃ Se ₄ (M) , In ₆ Se ₇ (m)
40	LaGa ₃ Hf ₂ + NaCl	920 °C to 500 °C 120h	Ga ₂ Hf(M)
41	La ₆ Ga ₃ Te ₁₄	880 °C 24h	GaTe(M) , LaTe ₂ (m)
42	La ₆ In ₃ Te ₁₄	880 °C 24h	La ₄ Te ₇ (M) , InTe(m)
43	La ₄ Ga ₅ Se ₁₃ + CsCl	880 °C 24h	La ₃ Se ₄ (M) , Cs ₂ Se ₅ (m)
44	La ₃ SnSe ₆	880 °C 24h	LaSe _{1.9} (M) , La ₃ Se ₄ (m)
45	La ₄ Ga ₅ Te ₁₃	880 °C 24h	(La ₂ Te ₃) _{.889} (M) , GaTe(m)
46	La ₆ Ga ₃ Te ₁₄	880 °C 24h	LaTe ₂ , (La ₂ Te ₃) _{.889} , GaTe
47	La ₆ GaInTe ₁₂ + NaCl	880 °C 24h	LaTe ₂ , (La ₂ Te ₃) _{.889} , NaGaTe ₂
48	La ₆ GaInS ₁₂ + NaCl	880 °C 24h	Na ₆ In ₂ S ₆ (M) , InCl(m) , α-S(m)
49	La ₄ In ₆ Se ₁₃	880 °C 24h	InSe(M) , Se(m) , unknown(m)
50	La ₄ Ga ₂ In ₃ S ₁₃ + KCl	920 °C to 500 °C 120h	In ₅ S ₄ (M) , GaInS ₃ (m)
51	La ₄ In _{4.66} Se ₁₃	920 °C to 500 °C 120h	La ₄ In _{4.66} Se ₁₃ (M)
52	La ₄ GaIn ₄ Se ₁₃	920 °C to 500 °C 120h	Ga ₃ La ₅ (M), α-In ₂ Se ₃ (m), InSe(m)
53	La ₄ In _{4.66} Se ₁₃ + KCl	825 °C 18h	K ₁₄ (In ₄ O ₁₃) · K ₂ Se ₃ · LaCl ₃
54	La ₄ In _{4.66} Se ₁₃ + NaCl	850 °C 18h	Cs ₂ Se ₅ · La ₃ Se ₄ · Cs ₂ (InCl ₅ (H ₂ O))
55	La ₄ GaIn ₄ Te ₁₃ + NaCl	850 °C 18h	InGaTe ₂ (M) , Te(m)
56	La ₄ In _{4.66} Se ₁₃ + CsCl	850 °C 18h	Cs ₂ Se ₅ · La ₃ Se ₄ · Cs ₂ (InCl ₅ (H ₂ O))
57	La ₄ Ga ₂ In ₃ S ₁₃	850 °C 18h	La ₄ In ₅ S ₁₃ (M) , S ₁₈ (m) , In ₆ S ₇ (m)
58	La ₄ GaIn ₄ Te ₁₃	850 °C 18h	InGaTe ₂ (M), LaTe ₂ (m), La ₄ Te ₇ (m)
59	La ₄ In _{4.66} Te ₁₃ + NaCl	850 °C 18h	InTe(M) , LaTe ₂ , Te(m), InCl(m)
60	La ₄ In _{4.66} Te ₁₃	850 °C 18h	In ₇ Te ₁₀ (M) , La ₄ Te ₇ (m), InTe(m)
61	La ₄ In ₅ S ₁₃ + NaCl	850 °C 18h	La ₄ In ₅ S ₁₃ (M) , S ₈ (m)
62	LaGa ₂	850 °C 18h	Ga ₃ La(M) , δ-La(m)
63	LaGa	850 °C 18h	GaLa(M) , Ga ₄ La(m)
64	La ₃ InSe ₆ + Ga	850 °C 18h	Ga ₂ Se ₃ (M) , In(m) , Se ₆ (m)
65	La ₄ PbIn ₄ S ₁₃ with NaCl	825 °C 18h	Pb ₄ In ₉ S ₁₇ (M), La ₂ S ₃ (m)
66	La ₄ PbIn ₄ Se ₁₃ with NaCl	825 °C 18h	Na _{1.37} La _{3.11} Pb _{1.55} In _{4.07} Se ₁₃ (M)
67	La ₄ MgIn ₄ Se ₁₃ with NaCl	825 °C 18h	Na _{1.82} La _{3.52} Mg _{0.48} In _{4.22} Se ₁₃ (M)
68	La ₄ GaIn ₄ Se ₁₃ with LiCl	825 °C 18h	In ₇ Se ₉ (M) , Ga ₃ La ₅ (m)
69	La ₄ PbIn ₄ Se ₁₃	825 °C 18h	Pb _{7.12} In _{18.88} Se ₃₄ (M) , In ₆ Se ₇ (m)
70	La ₆ In _{3.33} Se ₁₄ with NaCl	825 °C 18h	LaSe _{1.99} (M) , In ₆ Se ₇ (m)
71	La ₄ MgIn ₄ Se ₁₃	824 °C 18h	δ-In ₂ Se ₃ (M) , MgIn ₂ Se ₄ (m)
72	La ₄ PbIn ₄ S ₁₃	825 °C 18h	La ₄ In ₅ S ₁₃ (M), PbLaS ₄ (m), In ₂ S ₃ (m)
73	La ₄ Ga _{0.33} In _{4.33} Se ₁₃	850 °C 18h	In ₂ Se ₃ (M) , Se ₈ (m)

74	$\text{La}_4\text{Ga}_{0.66}\text{In}_4\text{Se}_{13}$	850 °C 18h	$\text{In}_2\text{Se}_3(\text{M})$, $\text{InSe}(\text{m})$
75	$\text{La}_4\text{GaIn}_{3.66}\text{Se}_{13}$	850 °C 18h	$\text{In}_2\text{Se}_3(\text{M})$, $\text{Ga}(\text{m})$
76	$\text{La}_4\text{Ga}_{1.33}\text{In}_{3.33}\text{Se}_{13}$	850 °C 18h	$\text{In}_2\text{Se}_3(\text{M})$, $\text{In}_5\text{La}_3(\text{m})$, $\text{Se}_6(\text{m})$
77	$\text{La}_4\text{Ga}_{1.66}\text{In}_3\text{Se}_{13}$	850 °C 18h	In_2Se_3 , $(\text{Ga}_{0.38}\text{In}_{0.62})_2\text{Se}_3$, GaSe
78	$\text{La}_4\text{Ga}_2\text{In}_{2.66}\text{Se}_{13}$	850 °C 18h	$\text{Ga}_3\text{La}_5(\text{M})$, $\text{LaSe}_2(\text{m})$, $\text{Ga}_2\text{Se}_3(\text{m})$
79	$\text{La}_4\text{Ga}_{2.33}\text{In}_{2.33}\text{Se}_{13}$	850 °C 18h	$\text{Ga}_2\text{Se}_3(\text{M})$, $\text{LaSe}(\text{m})$
80	$\text{La}_4\text{PbIn}_4\text{S}_{13}$	850 °C 18h	$\text{La}_4\text{In}_5\text{S}_{13}(\text{M})$, $\text{PbLaS}_4(\text{m})$, $\text{In}_2\text{S}_3(\text{m})$
81	$\text{La}_4\text{PbIn}_4\text{Se}_{13}$	825 °C 18h	$\text{Pb}_{7.12}\text{In}_{18.88}\text{Se}_{34}(\text{M})$, $\text{In}_6\text{Se}_7(\text{m})$
82	$\text{La}_4\text{ZnIn}_4\text{Se}_{13}$	850 °C 18h	$\text{ZnIn}_2\text{Se}_4(\text{M})$, $\text{LaSe}_{1.9}(\text{m})$, $\text{In}_6\text{Se}_7(\text{m})$
83	$\text{La}_6\text{MnGa}_2\text{Se}_{14}$	825 °C 18h	$\text{LaSe}_2(\text{M})$, $\text{Ga}(\text{m})$, $\text{Se}_6(\text{m})$
84	$\text{La}_6\text{MnIn}_2\text{Se}_{14}$	825 °C 18h	$\text{LaSe}_{1.9}(\text{M})$, $\text{Se}_8(\text{m})$, $\text{In}_6\text{Se}_7(\text{m})$
85	$\text{La}_6\text{PbGa}_2\text{Se}_{14}$	825 °C 18h	$\text{La}_3\text{Se}_4(\text{M})$, δ - $\text{La}(\text{m})$, $\text{GaSe}(\text{m})$
86	$\text{La}_6\text{PbIn}_2\text{Se}_{14}$	825 °C 18h	$\text{Pb}_{7.12}\text{In}_{18.88}\text{Se}_{34}(\text{M})$, $\text{LaSe}_{1.9}(\text{m})$
87	$\text{La}_4\text{In}_{4.66}\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{Na}_2\text{La}_4\text{In}_4\text{Se}_{13}(\text{M})$
88	$\text{La}_4\text{In}_{4.66}\text{Se}_{13}$	825 °C 18h	$\text{La}_4\text{In}_{4.66}\text{Se}_{13}(\text{M})$
89	$\text{La}_2\text{Pb}_4\text{In}_4\text{Se}_{13}$	800 °C 18h	$\text{Pb}_{7.12}\text{In}_{18.88}\text{Se}_{34}$, $\text{LaSe}_{1.9}$, In_4Se_3
90	$\text{La}_4\text{Pb}_4\text{In}_2\text{Se}_{13}$	800 °C 18h	$\text{In}_4\text{Se}_3(\text{M})$, PbSe , $\text{LaSe}_{1.9}$
91	$\text{La}_4\text{Ga}_{0.33}\text{In}_{4.33}\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{Na}_2\text{Ga}_2\text{Se}_3 \cdot \text{In}_4\text{Se}_{13} \cdot \text{LaSe}_{1.9} \cdot \text{Ga}_2\text{Se}_3$
92	$\text{La}_4\text{Ga}_{0.44}\text{In}_{4.22}\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{Na}_2\text{Ga}_2\text{Se}_3$, $\text{In}_4\text{Se}_{13}$, $\text{LaSe}_{1.9}$
93	$\text{La}_4\text{Ga}_{0.55}\text{In}_{4.11}\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{In}_4\text{Se}_{13}$, NaInSe , $\text{LaSe}_{1.9}$
94	$\text{La}_4\text{Ga}_{0.66}\text{In}_4\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{Na}_6\text{Ga}_2\text{Se}_6$, $\text{In}_4\text{Se}_{13}$, $\text{LaSe}_{1.9}$
95	$\text{La}_4\text{Ga}_{0.77}\text{In}_{3.99}\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{Na}_6\text{Ga}_2\text{Se}_6$, $\text{In}_4\text{Se}_{13}$, NaInSe
96	$\text{La}_4\text{Ga}_{0.88}\text{In}_{3.88}\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{In}_4\text{Se}_{13}$, $\text{LaSe}_{1.9}$, Ga_2Se_3
97	$\text{La}_4\text{GaIn}_{3.66}\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{In}_4\text{Se}_{13}$, $\text{LaSe}_{1.9}$, Ga_2Se_3 , Ga
98	$\text{La}_4\text{Ga}_{1.33}\text{In}_{3.33}\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{Na}_6\text{Ga}_2\text{Se}_6$, $\text{bata-Ga}_2\text{Se}_3$, LaSe_2
99	$\text{La}_4\text{Ga}_{1.66}\text{In}_3\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{Na}_6\text{Ga}_2\text{Se}_6$, Ga_2Se_3 , $\text{LaSe}_{1.9}$
100	$\text{La}_4\text{Ga}_2\text{In}_{2.66}\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{Na}_6\text{Ga}_2\text{Se}_6(\text{M})$, $\text{Ga}_2\text{Se}_3(\text{m})$, $\text{Ga}(\text{m})$
101	$\text{La}_4\text{Ga}_{2.33}\text{In}_{2.33}\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{bata-Ga}_2\text{Se}_3$, $\text{LaSe}_{1.9}$, In_6Se_7 , Ga
102	$\text{La}_4\text{In}_{4.66}\text{Se}_{13} + \text{CaCl}_2$	825 °C 18h	LaCl , LaSe_2 , In_2Se_3 , MgIn_2Se_4
103	$\text{La}_4\text{In}_{4.66}\text{Se}_{13} + \text{MgCl}_2$	825 °C 18h	α - $\text{In}_2\text{Se}_3(\text{M})$, $\text{LaSe}_{1.9}(\text{m})$
104	$\text{La}_4\text{ZnIn}_4\text{Se}_{13}$	825 °C 18h	$\text{ZnIn}_2\text{Se}_4(\text{M})$, $\text{LaSe}_{1.9}(\text{m})$, $\text{In}_6\text{Se}_7(\text{m})$
105	$\text{La}_4\text{MnIn}_4\text{Se}_{13}$	825 °C 18h	MnIn_2Se_4 , In_6Se_7 , α - In_2Se_3
106	$\text{La}_4\text{ZnIn}_4\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{ZnIn}_2\text{Se}_4(\text{M})$, $\text{Na}_2\text{La}_4\text{In}_4\text{Se}_{13}(\text{m})$
107	$\text{La}_4\text{MnIn}_4\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{Na}_{0.58}\text{La}_{3.52}\text{Mn}_{1.42}\text{In}_4\text{Se}_{13}(\text{M})$
108	$\text{La}_4\text{CaIn}_4\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{Na}_{1.83}\text{La}_{3.66}\text{Ca}_{0.26}\text{In}_{4.23}\text{Se}_{13}(\text{M})$
109	$\text{La}_4\text{SrIn}_4\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{Na}_{1.65}\text{La}_{3.85}\text{Sr}_{0.35}\text{In}_{4.04}\text{Se}_{13}(\text{M})$
110	$\text{La}_4\text{BaIn}_4\text{Se}_{13} + \text{NaCl}$	825 °C 18h	$\text{LaSe}_{1.9}(\text{M})$, $\text{SeCl}_4(\text{m})$, $\text{In}_6\text{Se}_7(\text{m})$