INTERACTION MECHANISM OF THE HYDROGENATION COMPOUND TiAl WITH OXYGEN

Chuprina V.G., Shalya I.M.
Frantsevich Institute for Problems of Material Science of NASU,
3 Krzizanovsky St, Kiev, 03142, Ukraine

The change of the state of surface of the TiAl compound after its interaction with the area oxygen under 500-900 °C was studied.

X-ray layer-by-layer phase analysis of the oxidation products was carried out. For this purpose from the homogenized TiAl ingot the columns with the ~1 mm diameter were made, then oxidized on the area and roentgenographed in the Debay-type camera (cassete diameter 150 mm) in the copper radiation. The X-ray investigation of the oxidized surface and also after the removal of the outside layer of certain thickness (Δd) were taken. After oxidation during the first hours under 500-600°C on the X-ray filme cjresponding to the oxidized surfase the strong alloy lines and week reflections of
γ-Al_2O_3 fixed. With the rizing of temperature and the oxidation time the α-Al_2O_3 and TiO_2 (rutile) lines are present on the X-ray films.

Some results of the X-ray phase analysis of the interaction products of TiAl with oxigen formed during 10 hours under 800 fnd 900 °C are represented on the table. There are values of $Sin^2\vartheta$ of the main lines (ϑ - Bregg's angle) and their corresponding intensiveness I/I_0. In the last column the reflection indexes (hkl) of the phases that may correspond them / 1 /are indicatted. Wide lines are marked as "w", and alloy lines as "al".

After the oxidation. under 800°C (τ=10 hours) the scale consisting with α-Al_2O_3 and TiO_2 breaks off. With the rise of the temperature up to 900 °C the interaction mechanism changes. The dense scale forms, in external layer (Δd=0) Ti_2O_3 appears (see the table). The same was observed also during TiNi [2] oxidation. This can be explained by the appearance of Ti^{4+} diffusion in the rutile latice, that leads not only to the increase of the rate constant of the parabolic oxidation, but also to the sintering of the scale.

Conclusions

1. Intermetallic compaund TiAl interacts with oxygen poorly under 500-600 °C.
2. Under t ≥ 800 °C Ti^{4+} diffusion to the external surface of the scale promotes the increase of the oxidation rate and the scale sintering.

References

1. Index to the X-ray powder data film.- Philadelfia: Amer. Soc. Test. Mat., 1972.
2. Chuprina V.G. Study of the Titanium Nickelide Oxidation Process.II.Phase Composition of scale. Powder Metallurgy, 1989, №6, 57-61.

Table

800°C Δd = 0 $Sin^2\theta$	τ=10 h I/I_0	Δd = 0 $Sin^2\theta$	900°C I/I_0	τ=10 h Δd = 0 $Sin^2\theta$	I/I_0	hkl фаза
-	-	0,0465	2	-	-	102-Ti_2O_3
0,0491	1	0,0490	1	-	-	102-α-Al_2O_3
0,0566	10	0,0569	6	0,0570	3	110-TiO_2
-	-	0,0813	1	-	-	110-α-Al_2O_3
0,0916	2	0,0917	1w	0,0915	1	014-Al_2O_3 ,104-Ti_2O_3
0,0966	8	0,0967	4	0,0970	1	001-TiO_2
0,1049	1	0,1053	1	-	-	110-α-Al_2O_3
-	-	-	-	0,1096	5w	al
0,1122	2	0,1125	1	-	-	020-TiO_2
0,1247	6	0,1224	7	-	-	111-TiO_2
-	-	-	-	0,1252	6	al
-	-	0,1324	1	-	-	Ti_2O_3
0,1358	2w	0,1365	2	0,1360	3	113-α-Al_2O_3
0,1402	2	0,1411	1	-	-	210-TiO_2
-	-	0,1704	2	-	-	024-Ti_2O_3
0,1961	2	0,1963	1	-	-	204-α-Al_2O_3
-	-	-	-	0,2042	5	al
0,2092	10	0,2086	9w	0,2081	4	121-TiO_2, 122-Ti_2O_3
0,2256	5	0,2253	3	0,2248	1	220-TiO_2
0,2309	3	0,2317	2	0,2305	1	116-α-Al_2O_3
-	-	0,2640	1	-	-	030-Ti_2O_3
0,2725	3	0,2740	2w	0,2710	1	022-TiO_2, 214-Ti_2O_3