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CHEMISTRY

Reaction of Platinum and Boron under Pressure

DURING some high-temperature-high-pressure experiments involving boron, a new phase appeared in the X-ray diffraction patterns of the samples. This phase was traced to the reaction of boron and the platinum foil used to encapsulate the sample between the chromo carbide pistons of a Griggs and Kennedy simple squeezer¹. Since platinum foil is a standard technique of sample enclosure for this type of experiment, it was decided to investigate the *P-T* phase diagram of this reaction so that it would not cause difficulty when encountered again.

At about the time this work was finished two papers came to our attention bearing on this problem and have prompted us to publish our results. The first was a paper by Jamieson and Lawson² in which they referred to the formation of a new phase from boron at 600°C and

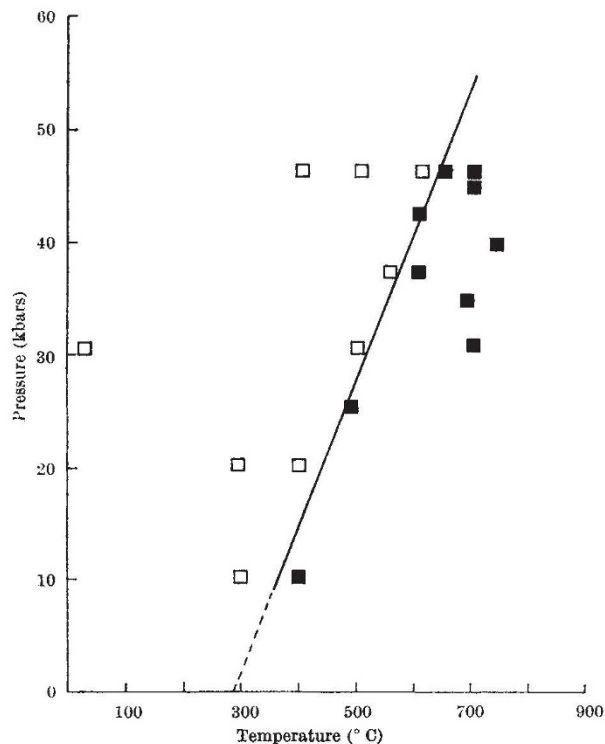


Fig. 1. Phase diagram for the reaction $B + Pt \rightarrow PtB$. White squares indicate no reaction; black squares indicate the formation of platinum boride

Table 1. COMPARISON OF X-RAY DATA FOR PLATINUM BORIDE

<i>hkl</i>	Aronsson		Jamieson		Whitney and Giese		<i>d, calc.</i>
	<i>d</i>	<i>I</i>	<i>d</i>	<i>I</i>	<i>d</i>	<i>I</i>	
100	2.903	st	2.896	st	2.906	6	2.908
101	2.360	v st	2.364	v st	2.370	10	2.364
002	2.025	m	2.041	m	2.049	2	2.029
102	1.663	st }	1.671	st	1.675	8	1.664
110	1.676	st }					
200	1.453	w	1.450	w	1.451	1	1.454
201	1.365	st	1.367	st	1.367	5	1.369
112	1.291	st+	1.295	st+	1.296	6	1.294
103	1.225	m+	1.232	m+	1.234	4	1.227
202	1.180	m	1.182	m	1.184	1	1.182
210			1.097	v w	1.096	1/2	1.099
211			1.063	m	1.059	4	1.061
203			0.9940	w	0.9928	2	0.9904
212					0.9661	2	0.9685
302					0.8795	4	0.8747
213					0.8540	4	0.8530
220					0.8373	1/2	0.8395
303					0.7889	3	0.7879

40 kilobars (kb). No mention was made of platinum and, in reply to a letter of ours, Prof. Jamieson confirmed our suspicion that platinum foil was in contact with the boron. He was also kind enough to send us X-ray photographs of his samples. It will be seen that this new phase lies just to the right of the boundary between boron and platinum and platinum boride (Fig. 1).

A recent paper by Aronsson *et al.*³ has allowed us to identify the platinum boride as PtB (space group $P\bar{6}_3/mmc$, $a = 3.36 \text{ \AA}$, $c = 4.06 \text{ \AA}$), and to confirm the identity of Jamieson's material with our platinum boride. There are a few weak X-ray diffraction lines not due to PtB which can be attributed to B_2O_3 and the original boron.

The slope of the curve shown in Fig. 1 was found to have a value of $dP/dT = 133 \text{ bars degree}^{-1}$. It is of interest to note that Strong and Bundy⁴ found the value of dP/dT for the melting point of platinum to be $140 \text{ bars degree}^{-1}$.

The X-ray diffraction results are listed in Table 1. We are grateful to Prof. Jamieson for permission to examine his films and publish the results.

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Electrical Storage and Hydrogen Transfer between Electrodes of Palladium and Palladium Alloys

ELECTRODES of palladium and palladium alloys can absorb large volumes of hydrogen. In general, the solid hydrides retain excellent electrical conductivity and are not severely embrittled or disrupted. For pure palladium, and for many alloys, the relationships between electrode potential E (with respect to a hydrogen reference electrode in the same solution) and hydrogen content (written here, Fig. 1, as the ratio, H/Me , of hydrogen atoms to the total number of metal atoms) exhibit 'plateau' regions—over which α - and β -phase hydrides co-exist—where E is relatively invariant ($E_{\alpha,\beta}$). Over such 'plateau' regions, hydrogen transfer should, in principle, occur at a constant rate when connexion is made between an alloy and palladium or between two alloys. However, polarization¹ would be expected to occur rapidly if the diffusion of hydrogen within the electrodes were not sufficiently fast for the concentration of hydrogen at the surfaces to be continuously representative of the ranges of H/Me corresponding to the plateaux. The following experiments serve to illustrate what may be observed in practice.

The $E-H/Me$ relationships, at 25°C, for palladium and two selected alloys¹⁻³ are shown in Fig. 1, where full lines indicate relationships which apply when hydrogen