PRODUCTION OF HELIUM AND ENERGY IN THE "SOLID FUSION"

Y. Arata, Y.C. Zhang, and X.F. Wang
Center for Advanced Science and Innovation, Osaka University
2-1 Yamadaoka, Suita, Osaka, 565-0871, Japan

In this paper, A new type "Solid Fusion Reactor" has been developed to test the existence of solid state nuclear fusion (" Solid Fusion"): reproducible experiments have been made at room temperature and without external power input. Both of the energy and Helium generation affected by the reactor structure, gas flow rate, powder weight, and cooling condition were studied. Deuterium gas loading processes of two types of nanomaterial ($ZrO_2 \cdot Pd_{35}$ and $ZrO_2 \cdot Ni_{30}Pd_5$) were studied respectively in this paper. The results showed the energy produced in $ZrO_2 \cdot Ni_{30}Pd_5$ is higher than in $ZrO_2 \cdot Pd_{35}$. Helium as an important evidence of solid-state fusion was detected by mass analyzer "QMS". As result, " Solid Fusion" has been confirmed by the helium existence, and then we developed the Helium production system.

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Y. Arata

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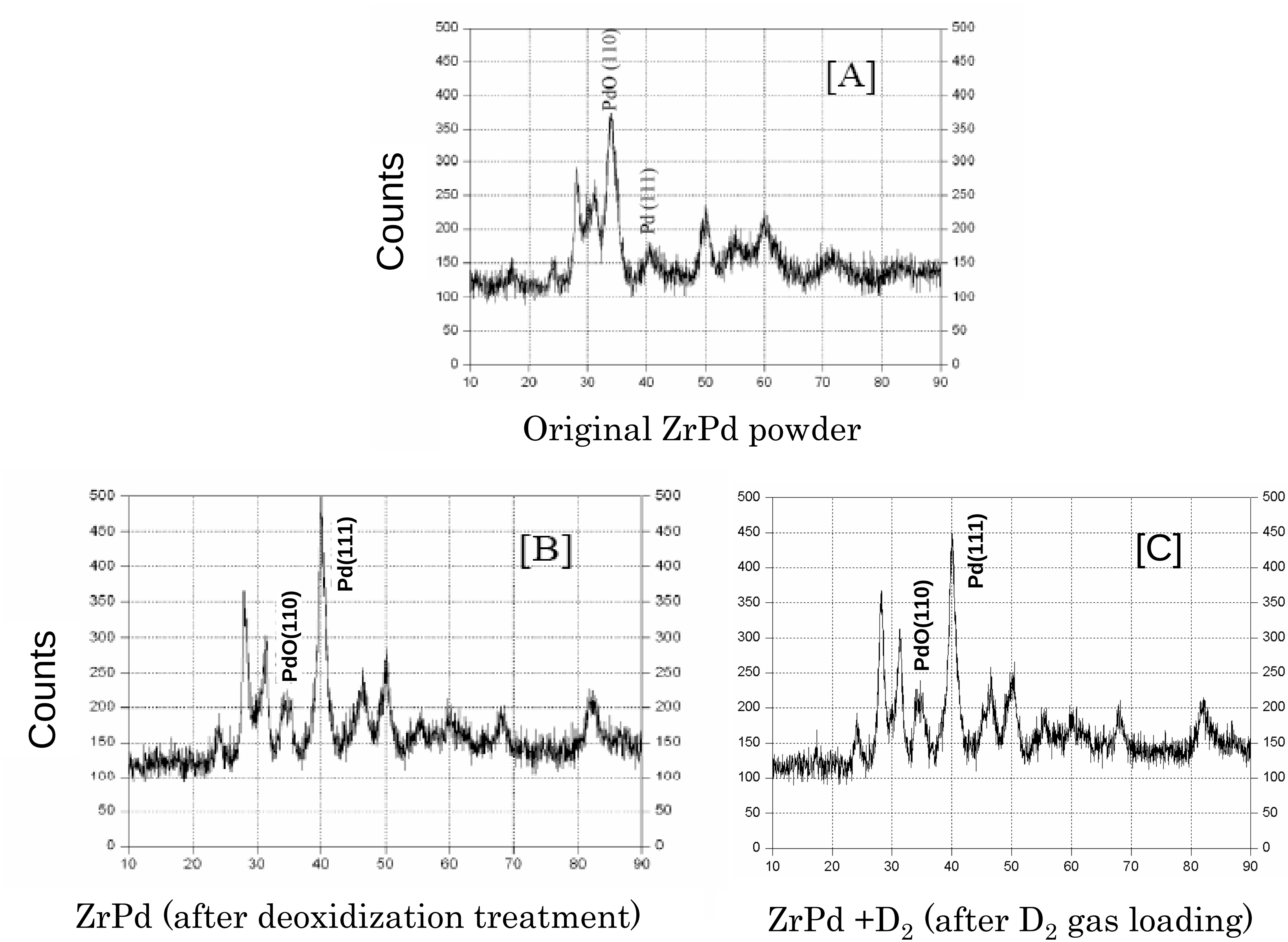


Original ZrPd powder

ZrPd (after deoxidization treatment)

ZrPd +D_2 (after D_2 gas loading)

Fig.1 X-ray diffraction analysis

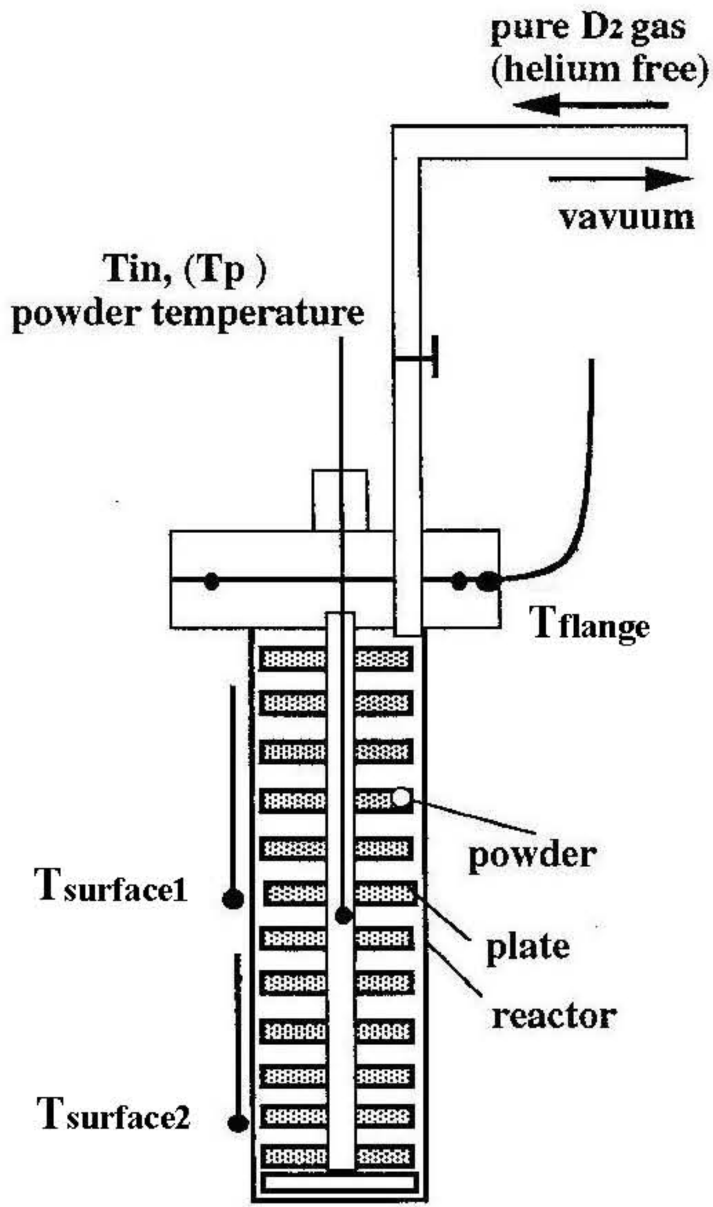


Fig.2 Fusion reactor

[A]

[B]

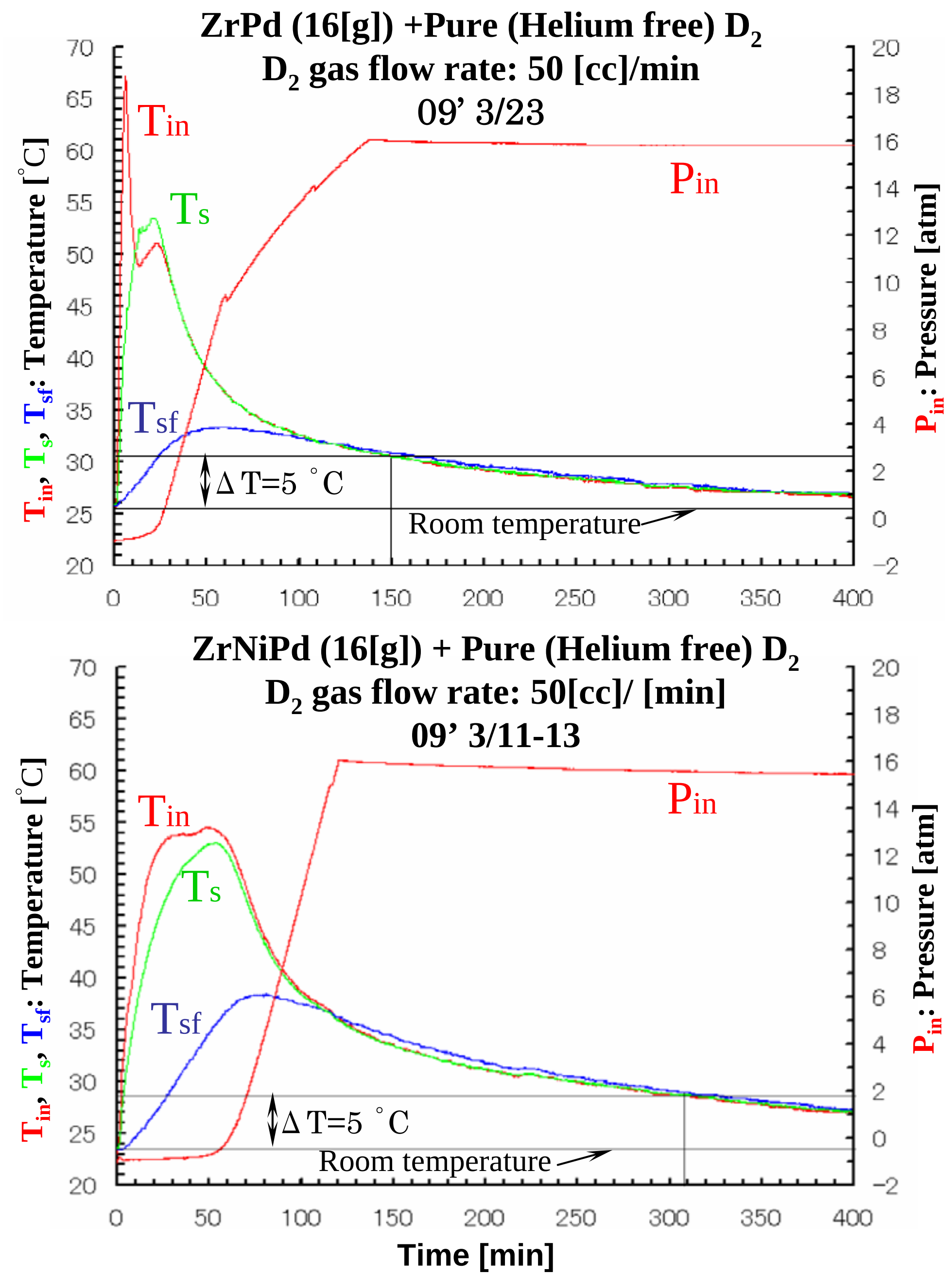


Fig.3 Distribution of temperature and pressure

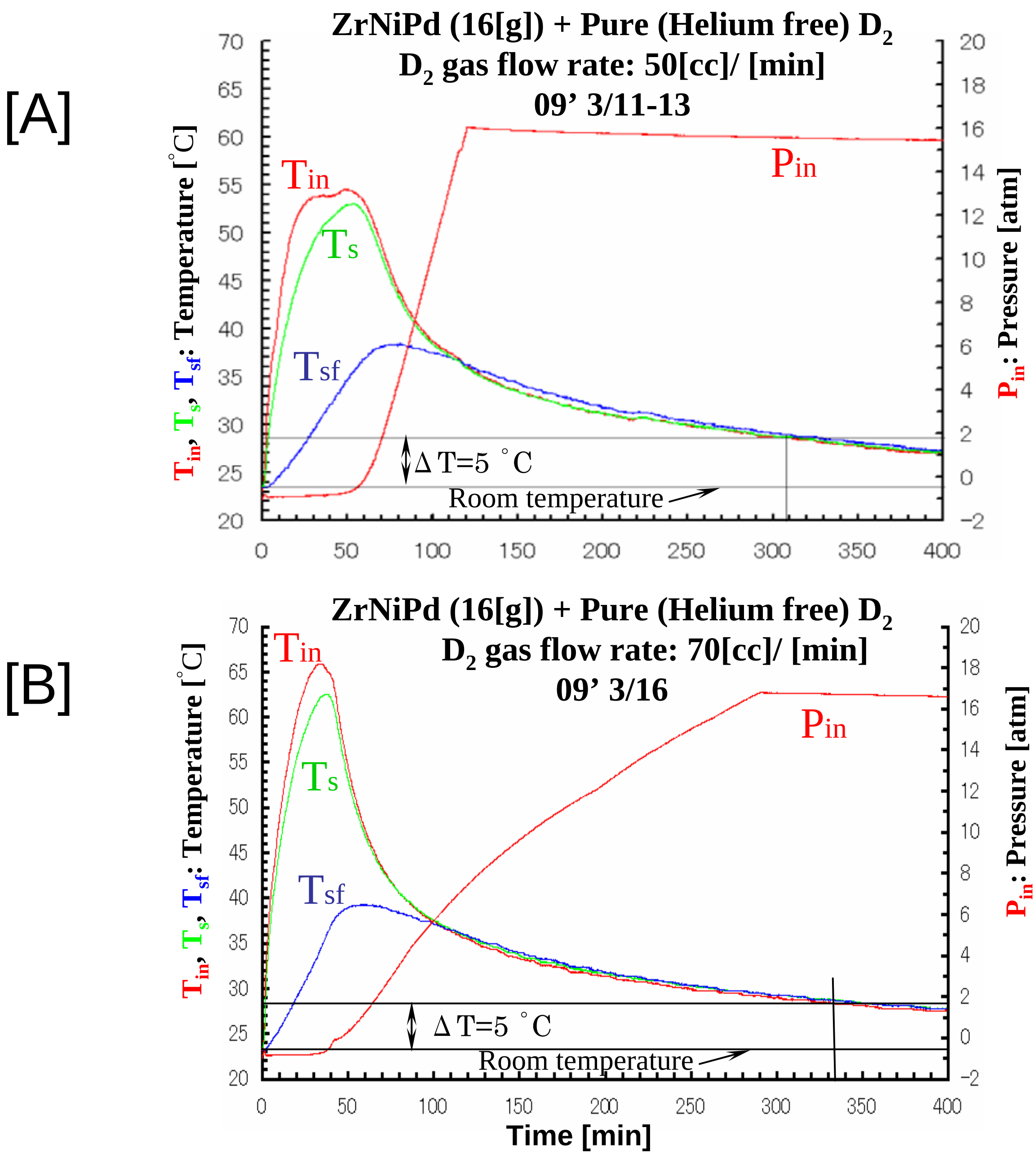
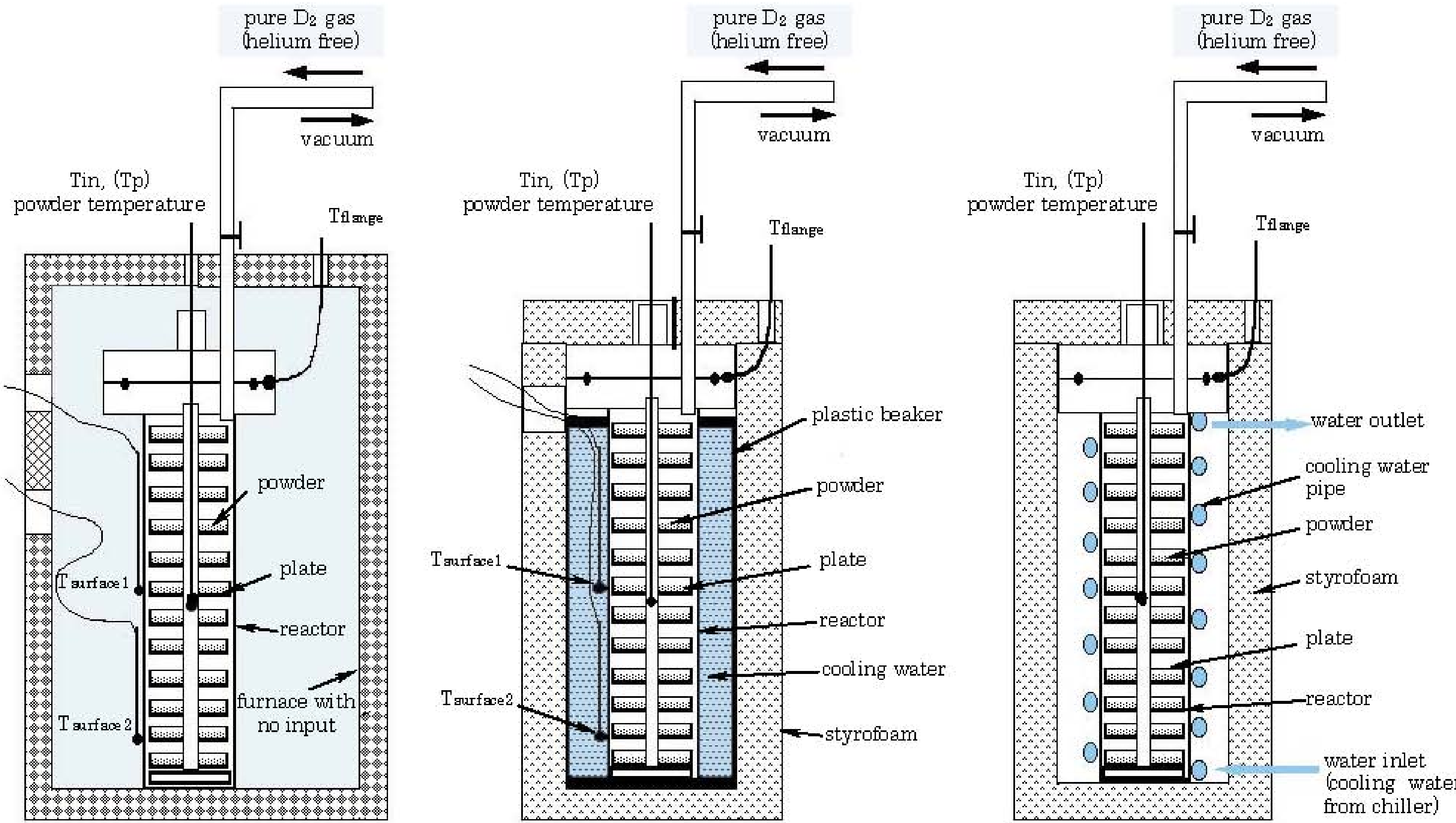


Fig.4 Distribution of temperature and pressure

Fig.5 Three kinds of cooling type during D_2 gas loading



Cooling type-1
cooling in air with shelter

Cooling type-2
cooling in water bath

Cooling type-3
cooling water using a chiller

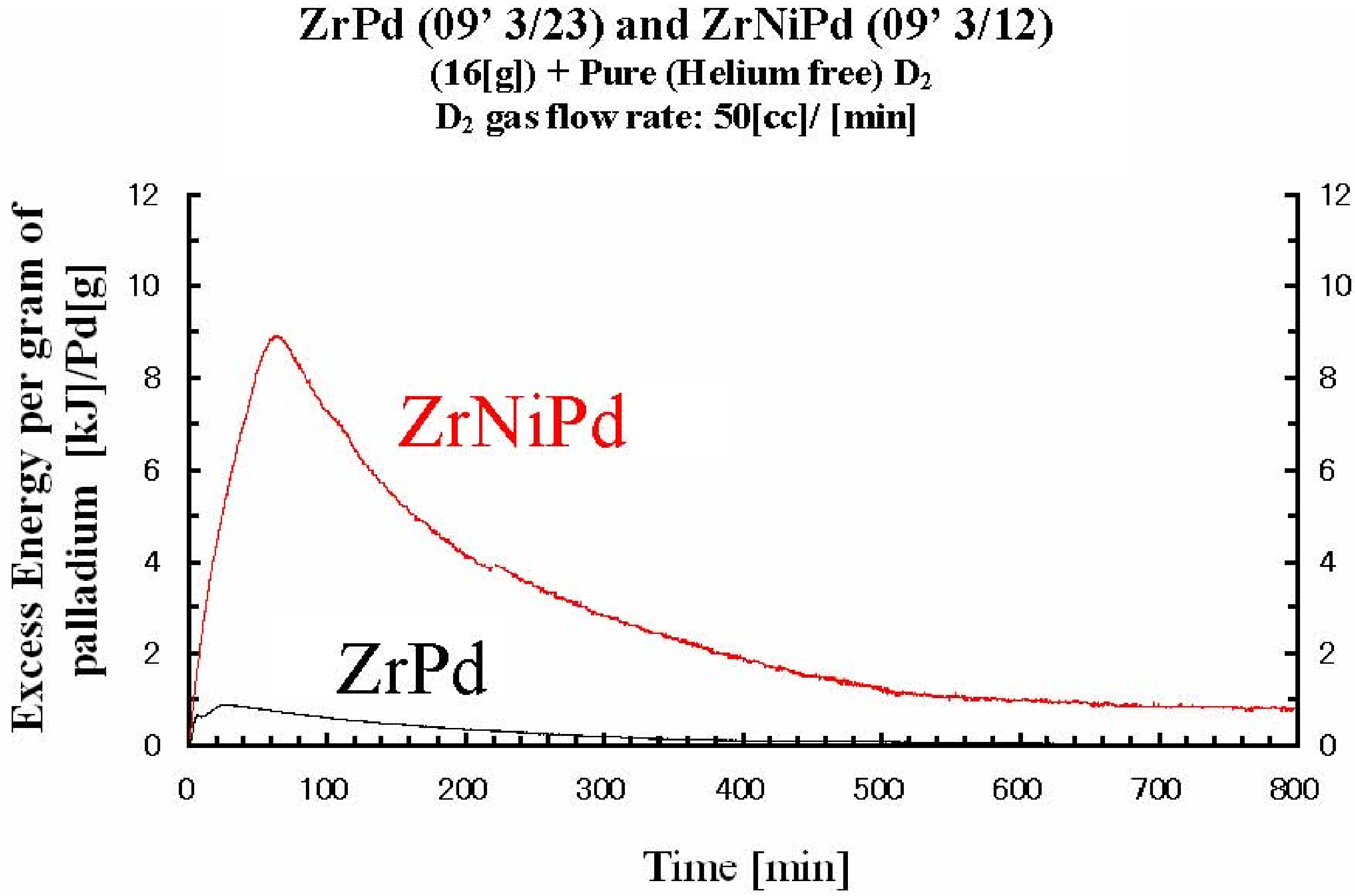

ZrPd (09' 3/23) and ZrNiPd (09' 3/12)
(16[g]) + Pure (Helium free) D_2
D_2 gas flow rate: 50[cc]/ [min]
Excess Energy per gram of palladium [kJ]/Pd[g]
ZrNiPd
ZrPd
Time [min]
0
100
200
300
400
500
600
700
800
0
2
4
6
8
10
12

Fig.6

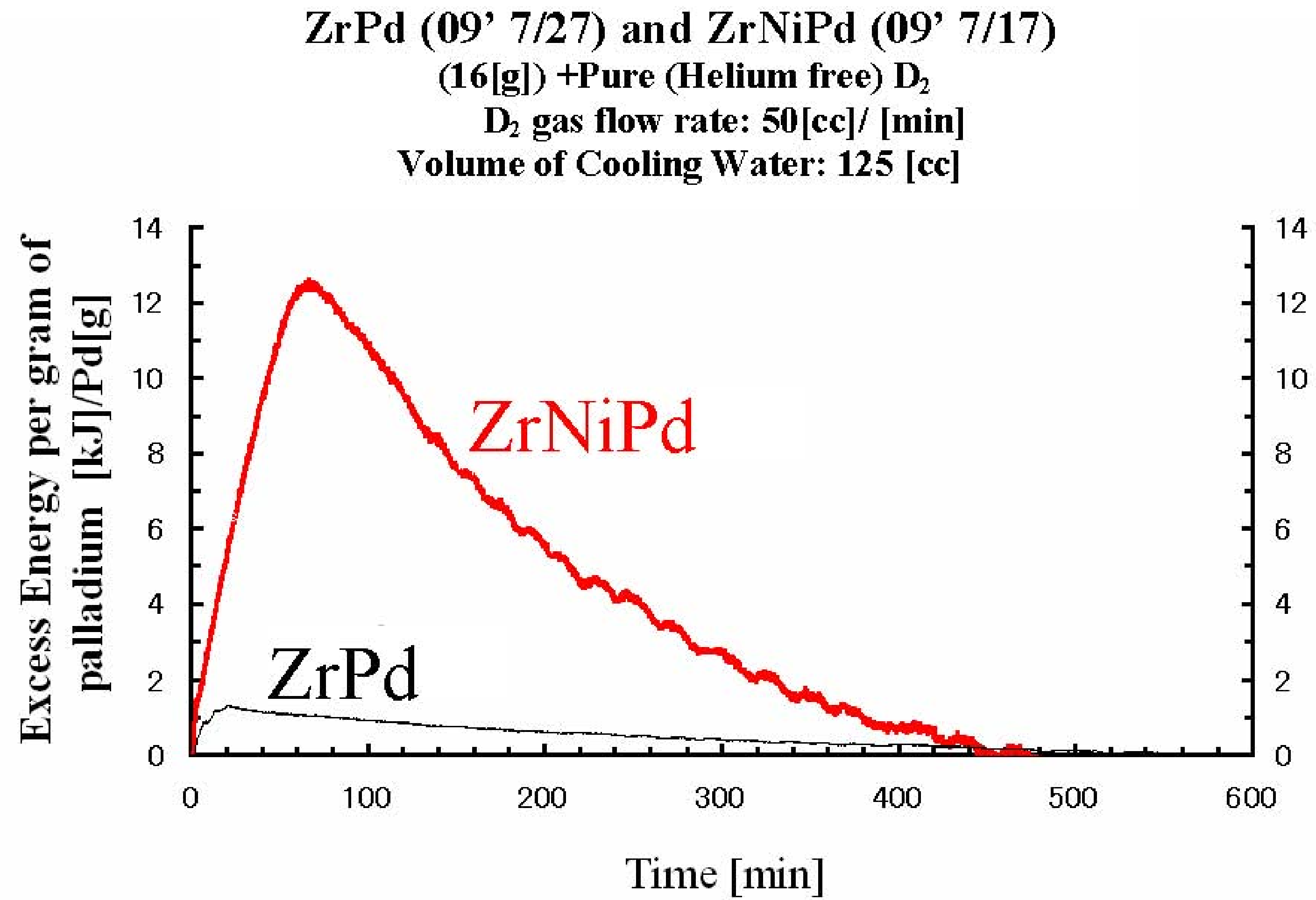

ZrPd (09' 7/27) and ZrNiPd (09' 7/17)
(16[g]) +Pure (Helium free) D2
D2 gas flow rate: 50[cc]/ [min]
Volume of Cooling Water: 125 [cc]
Excess Energy per gram of palladium [kJ]/Pd[g]
ZrNiPd
ZrPd
Time [min]
0
100
200
300
400
500
600
0
2
4
6
8
10
12
14

Fig.7

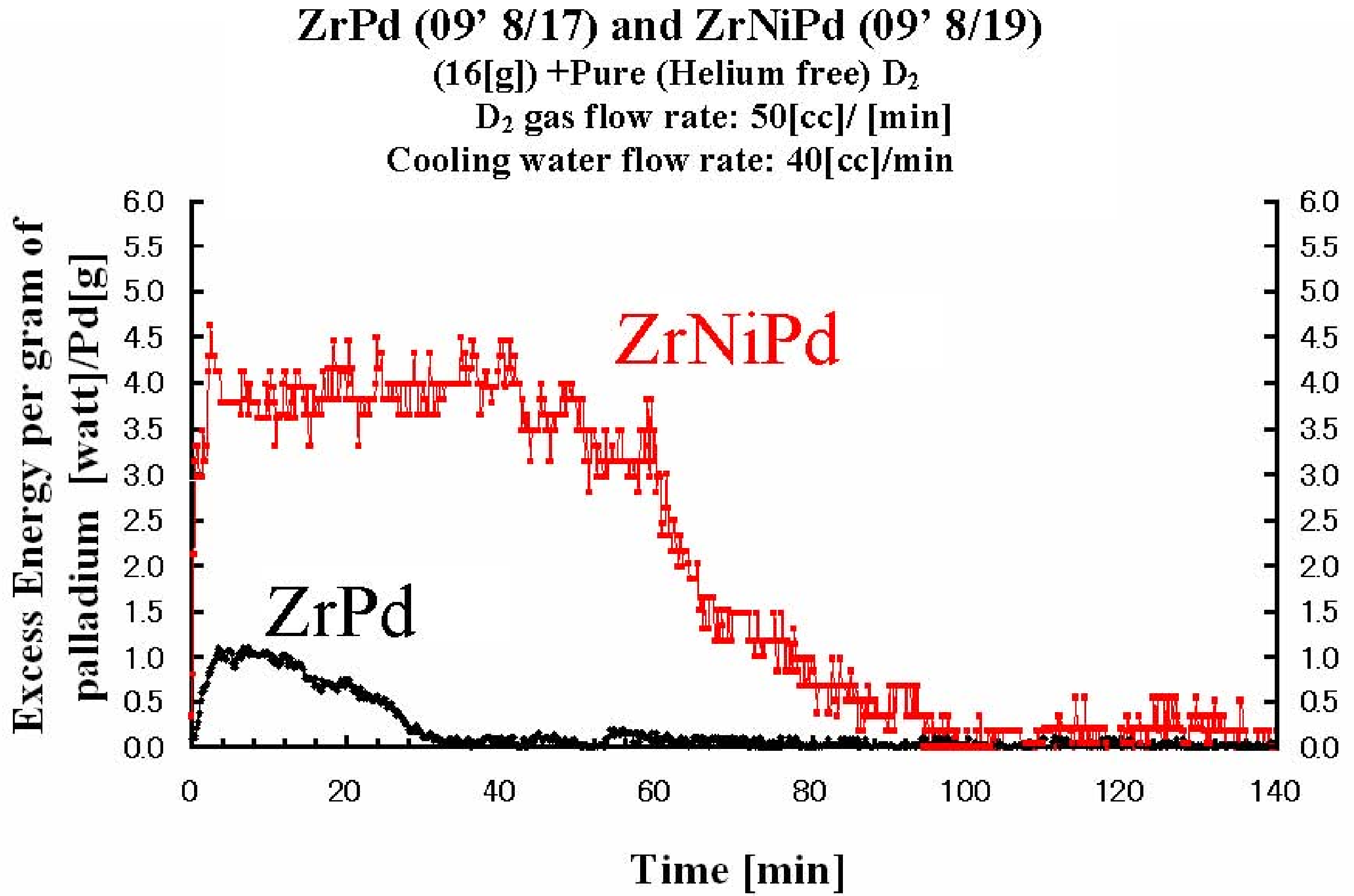
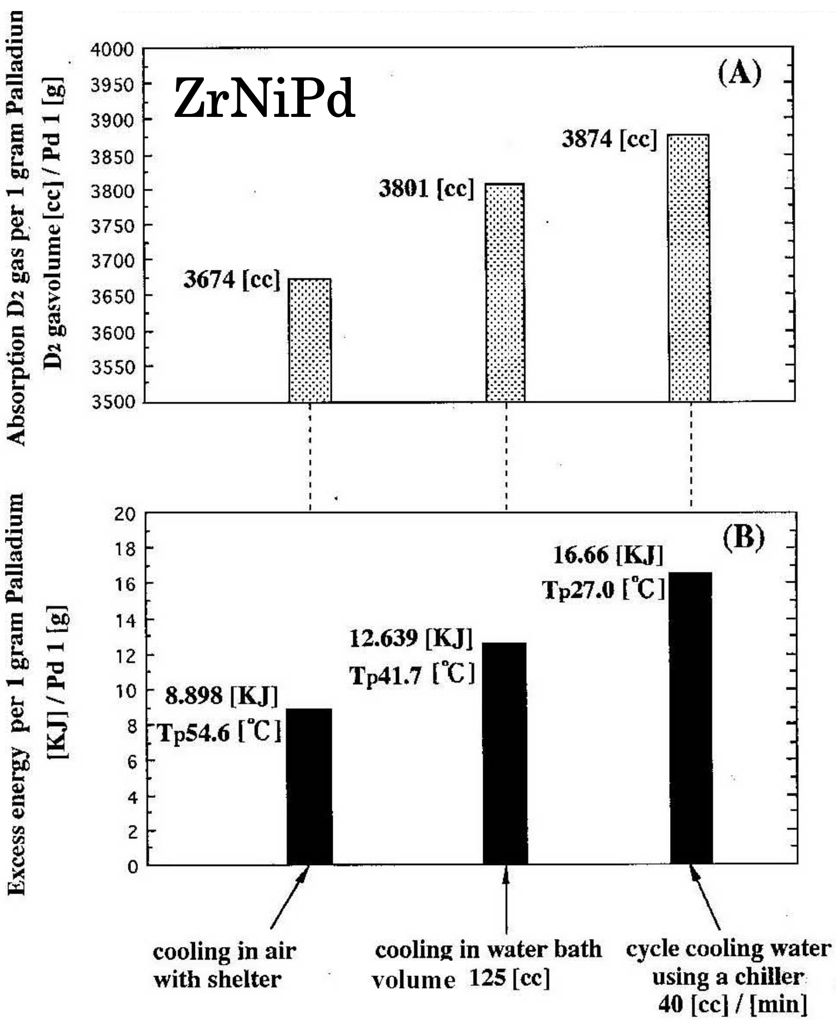
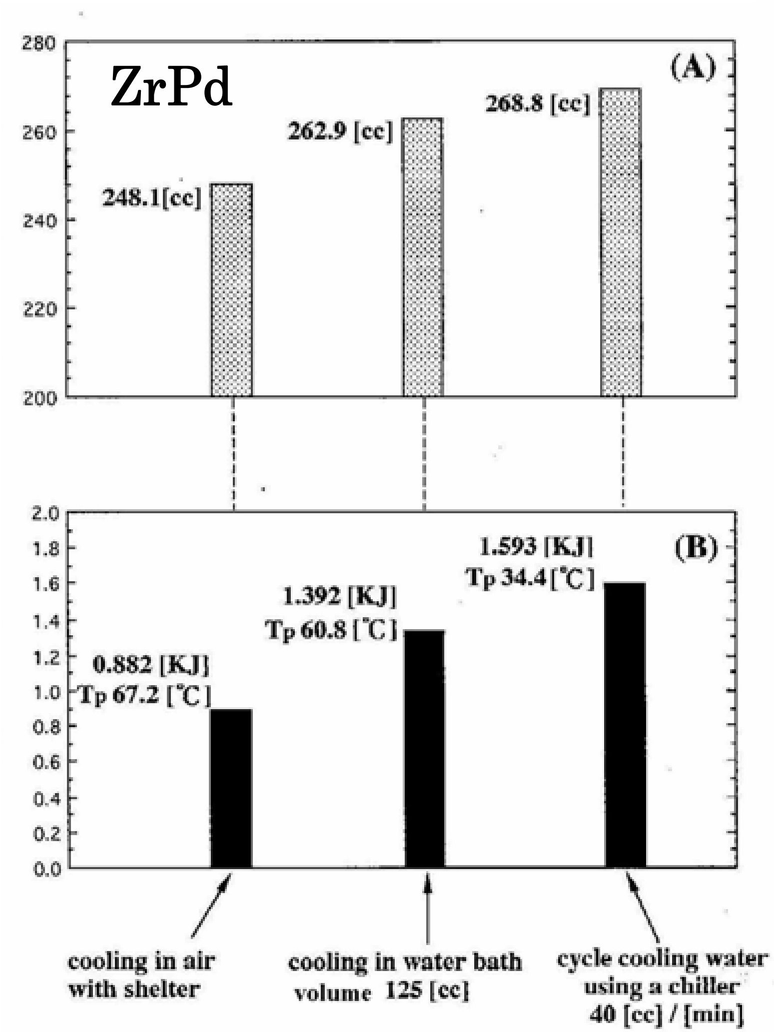

ZrPd (09' 8/17) and ZrNiPd (09' 8/19)
(16[g]) +Pure (Helium free) D2
D2 gas flow rate: 50[cc]/ [min]
Cooling water flow rate: 40[cc]/min
Excess Energy per gram of palladium [watt]/Pd[g]
ZrNiPd
ZrPd
Time [min]
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
0
20
40
60
80
100
120
140

Fig.8

Absorption volume of D_2 gas and excess energy of the powder (16[g]) during the pure D_2 gas loading under the same conditions except for the cooling condition.





T_p: powder temperature at the highest point during D_2 gas loading

Fig.9 ZrNiPd powder

Fig.10 ZrPd powder

Comparison of the absorbed D_2 gas volume and excess energy between ZrNiPd powder and ZrPd powder under different gas flow rate.

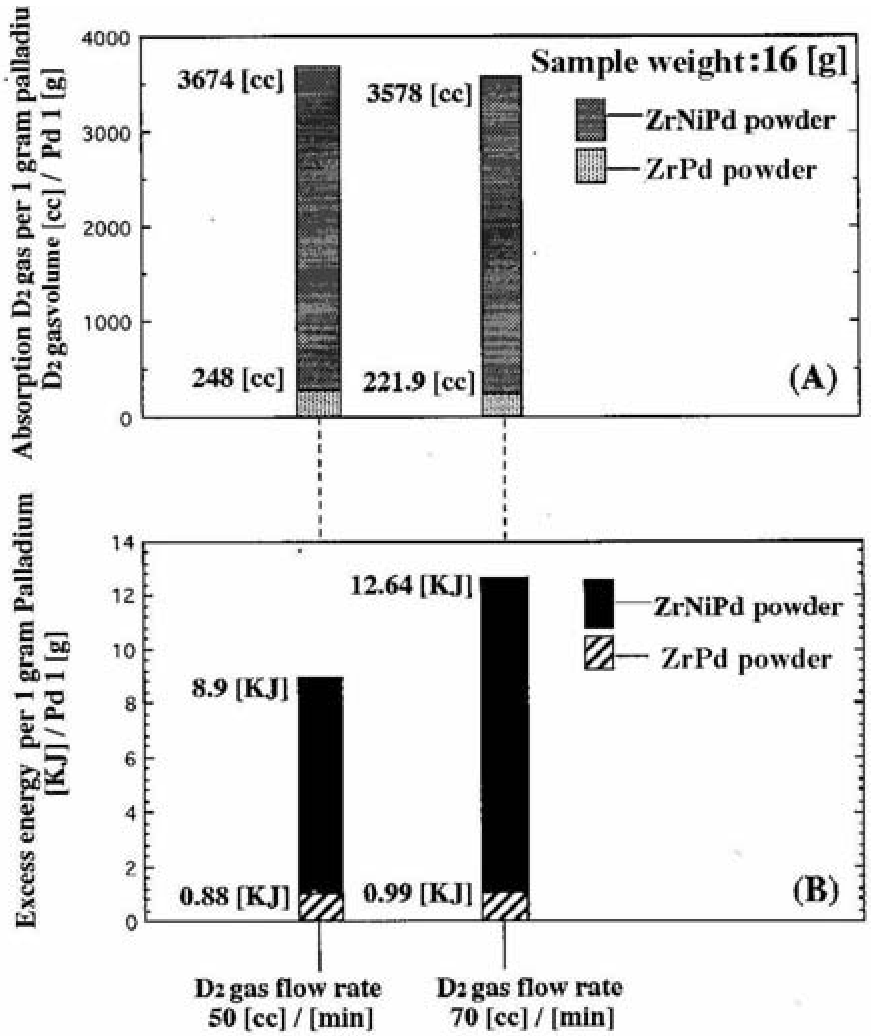


Fig.11

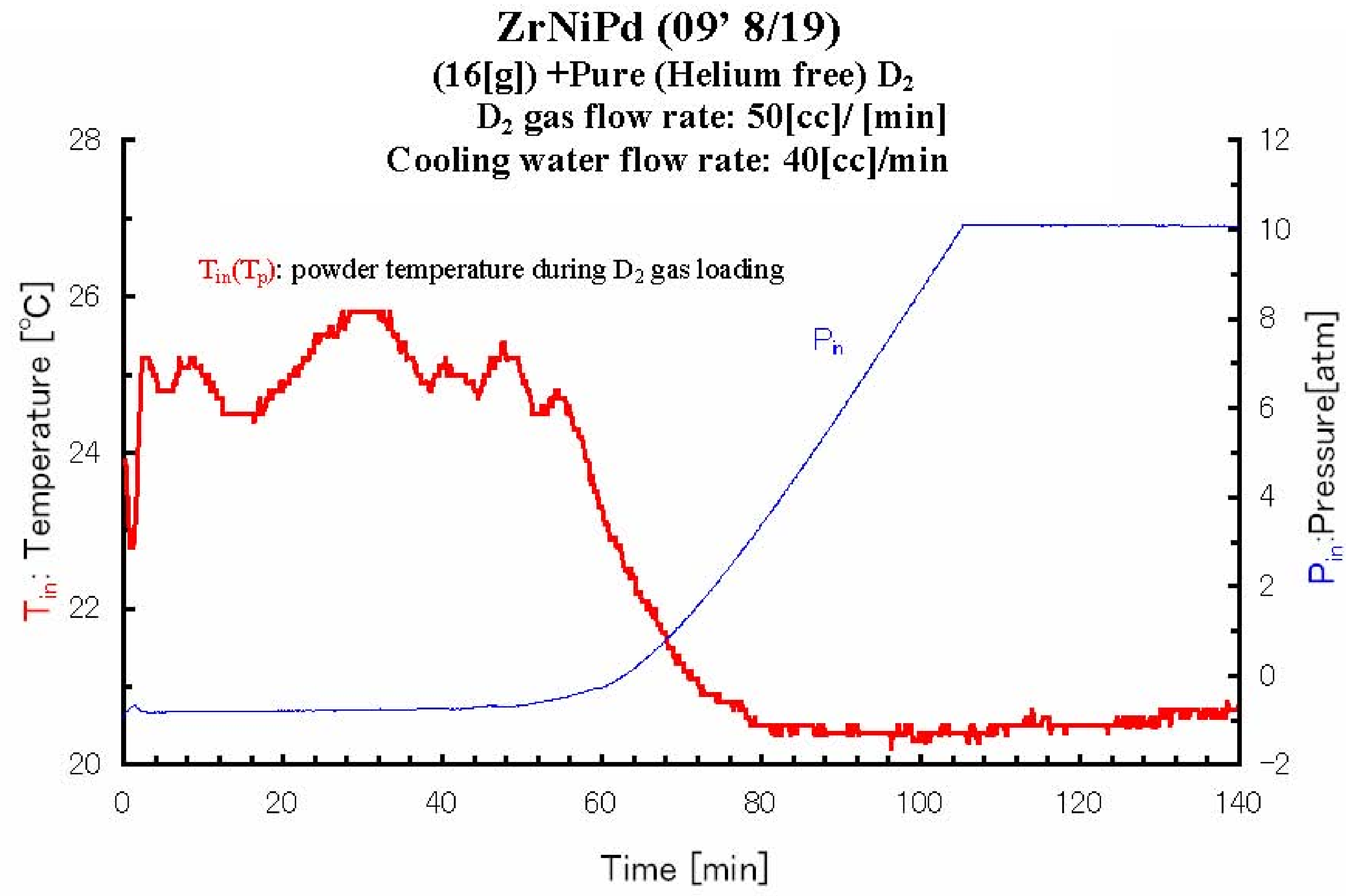
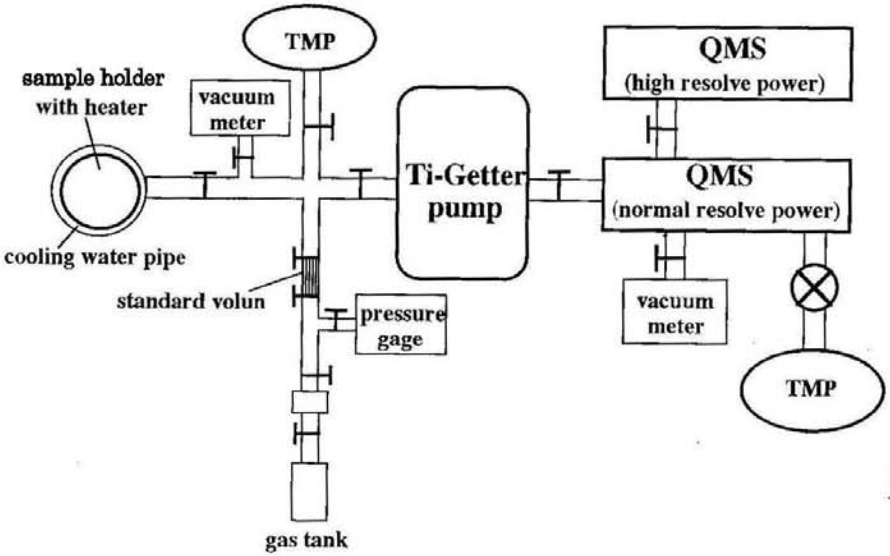

ZrNiPd (09' 8/19)
(16[g]) +Pure (Helium free) D2
D2 gas flow rate: 50[cc]/ [min]
Cooling water flow rate: 40[cc]/min
Tin(Tp): powder temperature during D2 gas loading
Pin
Tin: Temperature [°C]
Pin:Pressure[atm]
Time [min]
28
26
24
22
20
12
10
8
6
4
2
0
−2
0
20
40
60
80
100
120
140

Fig.12



Mass analysis apparatus - "QMS".

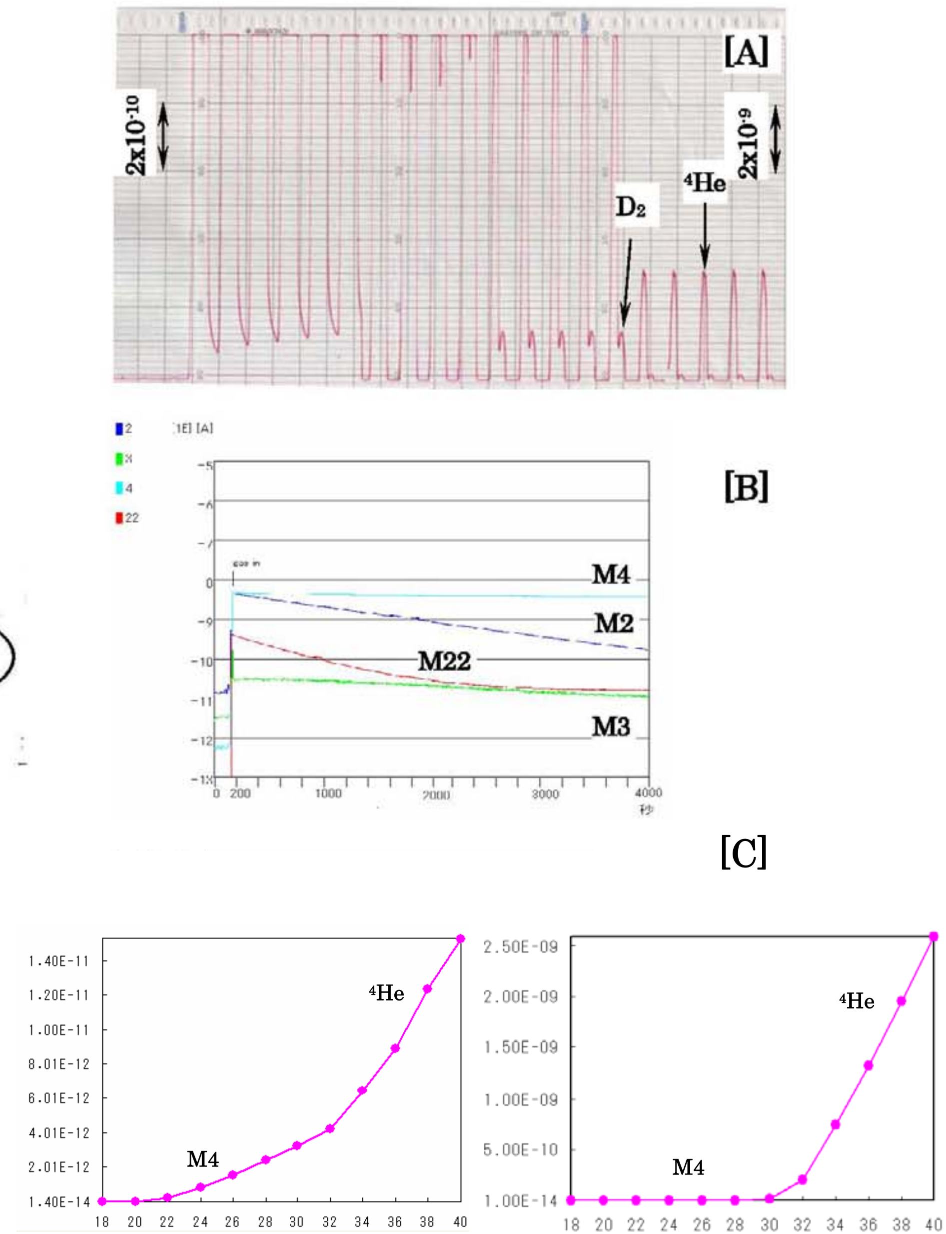


Fig.13

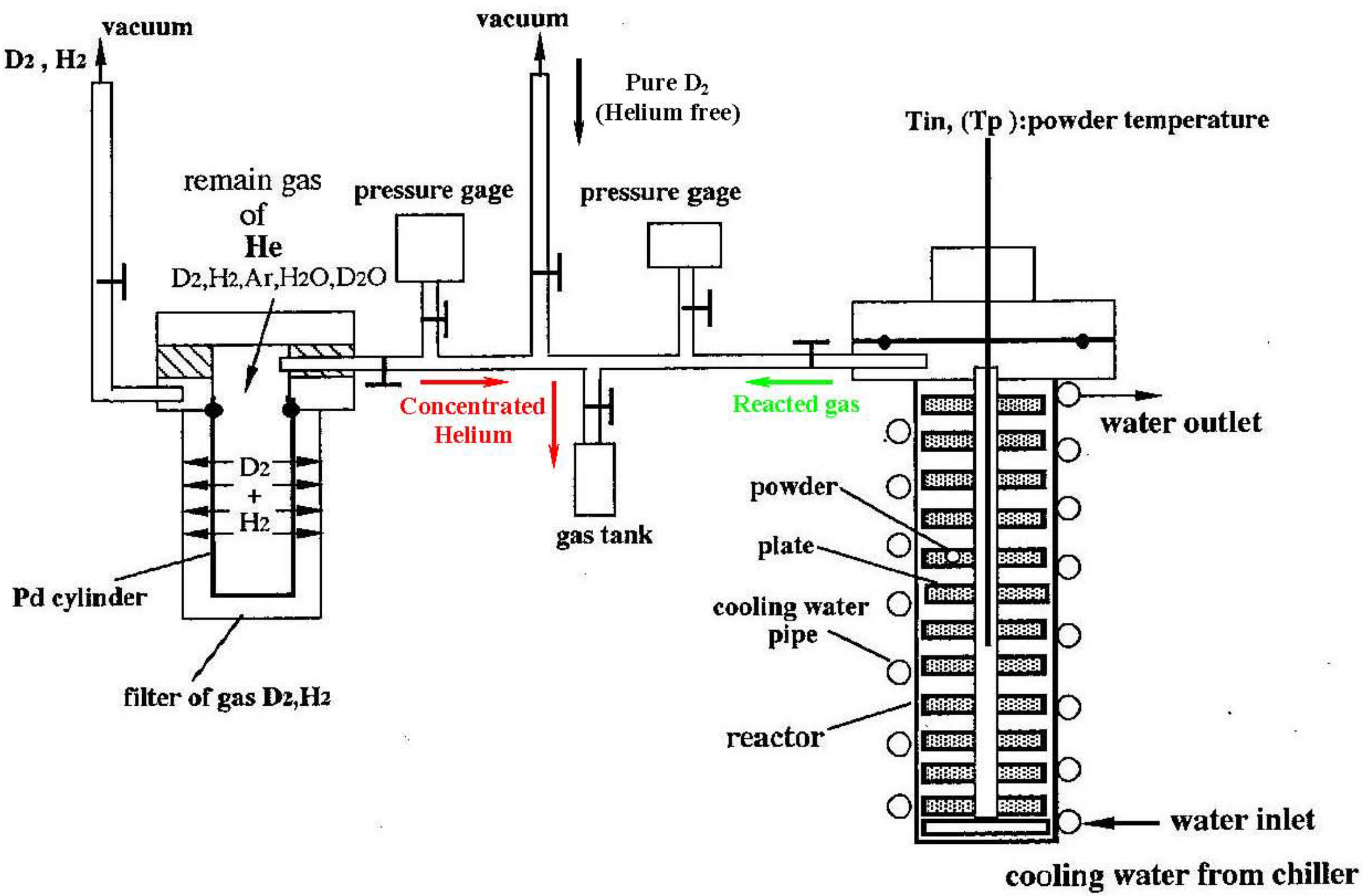


Fig.14 Concentration apparatus of Helium from reacted powders

(A) ZrNiPd powder

(B) ZrPd powder

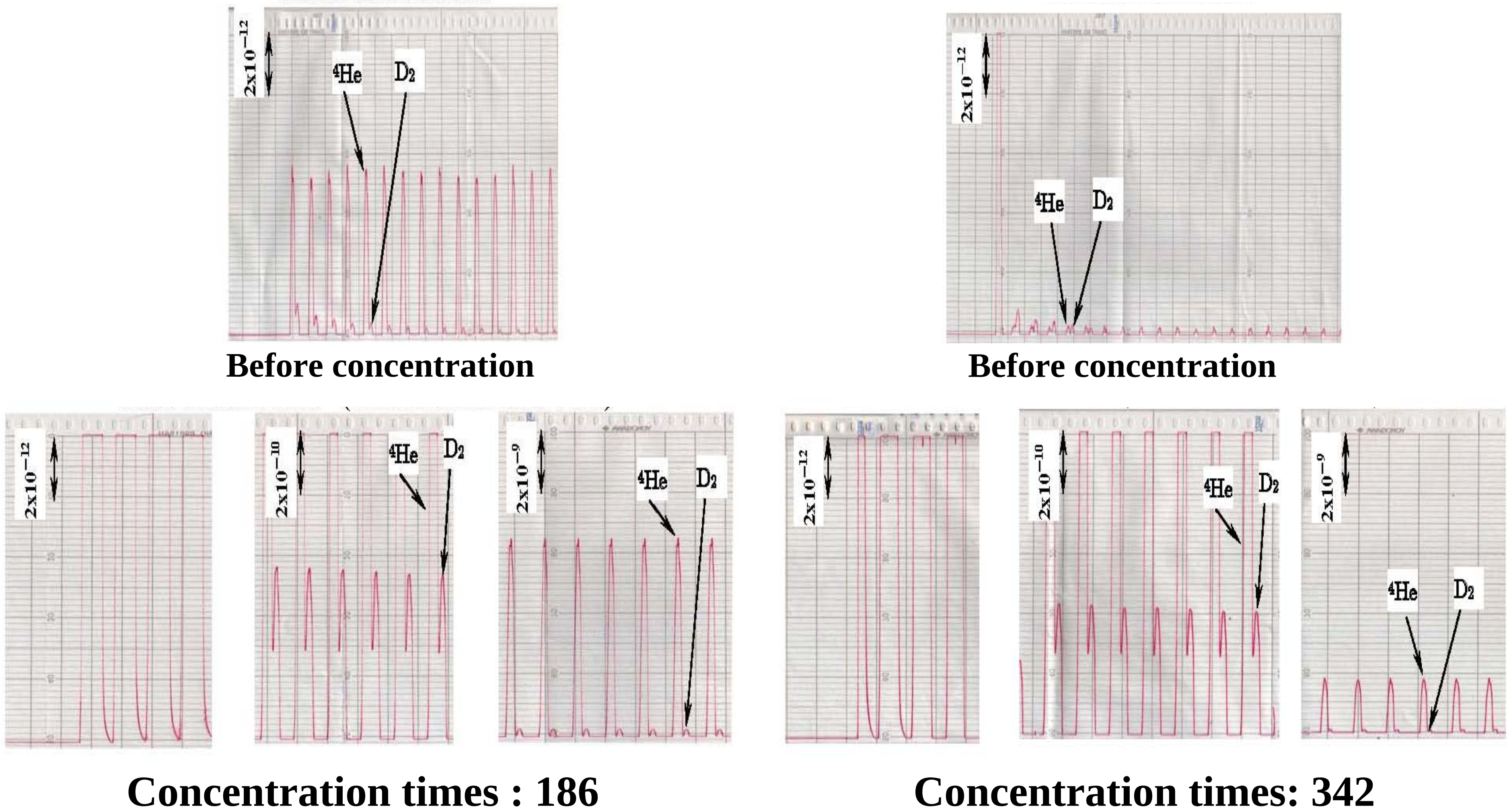


Fig.15 Spectrum of reaction products

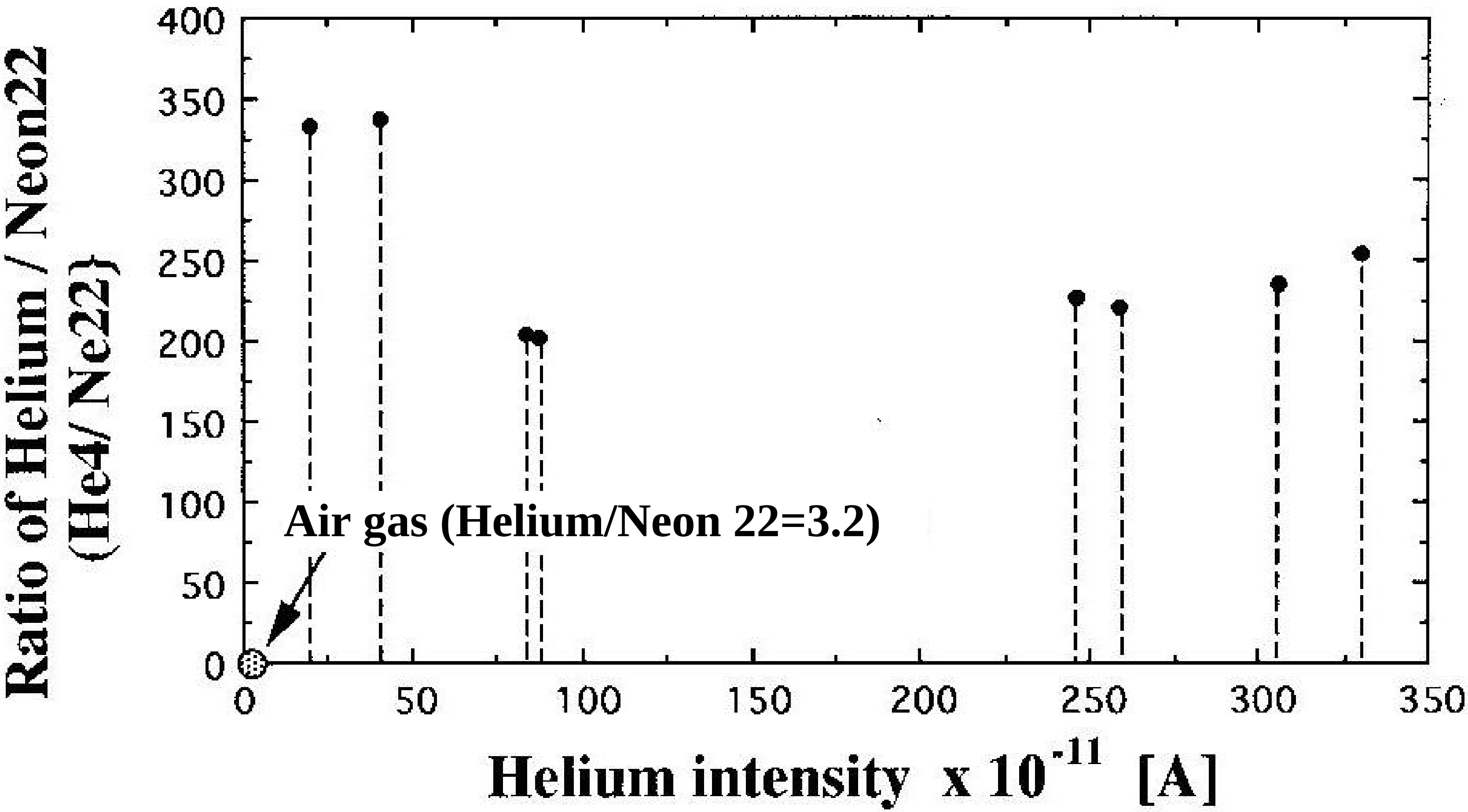


Fig.15C Helium intensity and the intensity ratio of Helium per Neon22 detected from reacted gas of ZrNiPd powder using "QMS"

Helium intensity relation to concentration Times with loading using cooling type-3

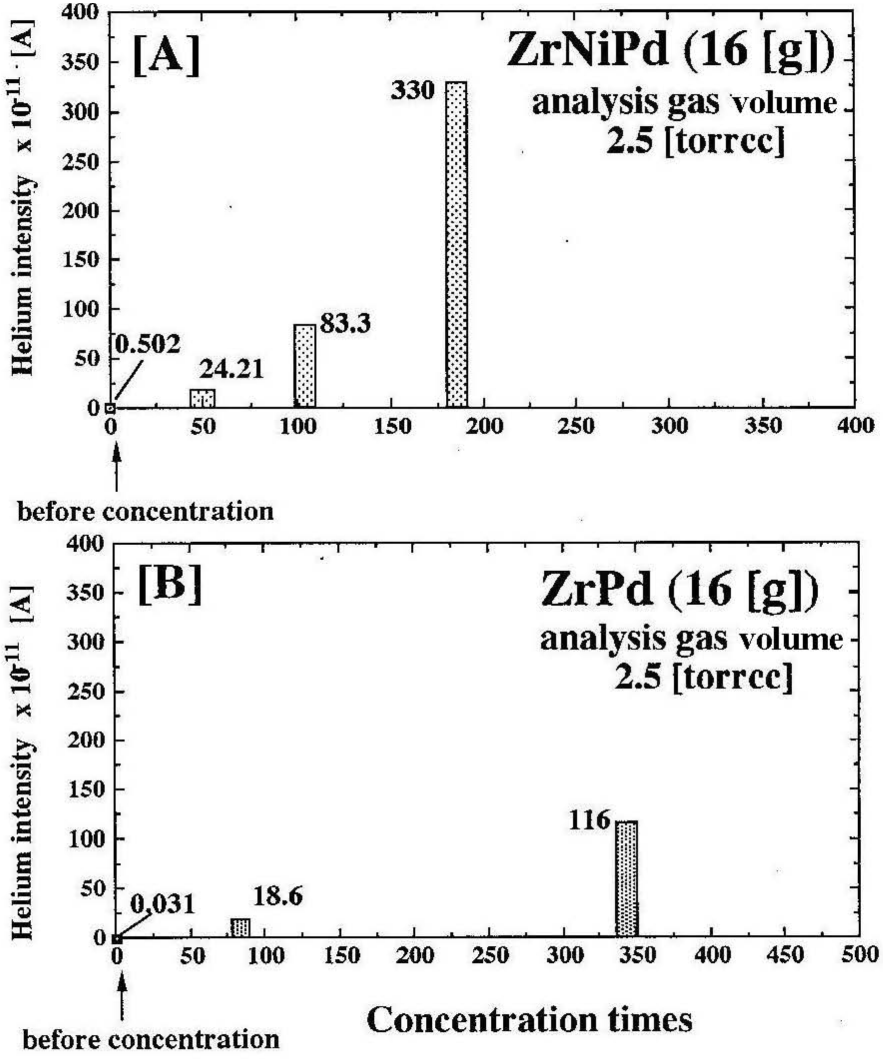


Fig.16

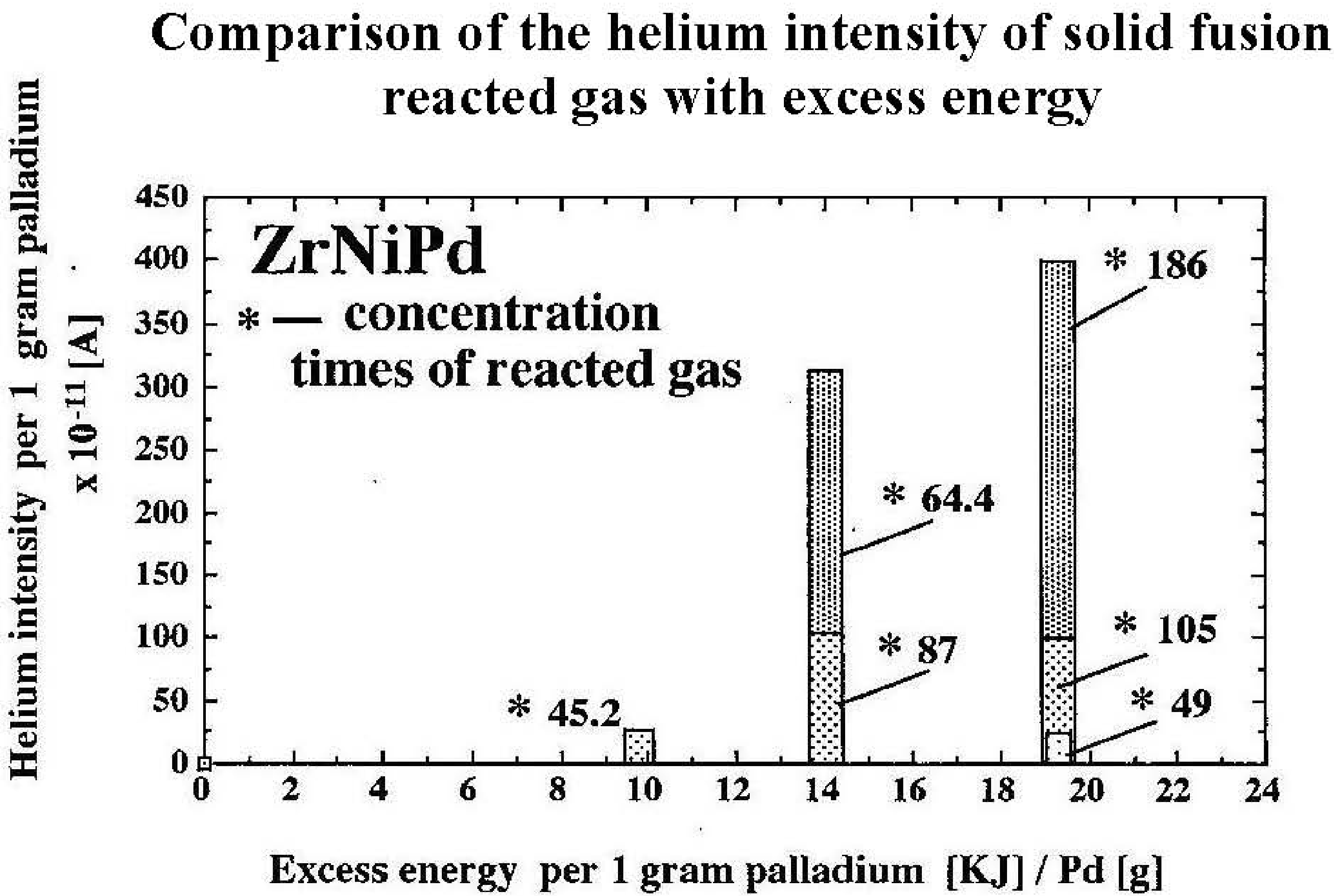

Comparison of the helium intensity of solid fusion
reacted gas with excess energy
Helium intensity per 1 gram palladium
x 10-11 [A]
ZrNiPd
* — concentration
times of reacted gas
* 186
* 64.4
* 87
* 105
* 49
* 45.2
0
50
100
150
200
250
300
350
400
450
0
2
4
6
8
10
12
14
16
18
20
22
24
Excess energy per 1 gram palladium [KJ] / Pd [g]

Fig.17

- **Conclusion:**
- (1)Either excess energy or helium of the ZrNiPd powder is always about ten times higher than that of the ZrPd powder.
- (2)By using the weight 16 [g] of the ZrNiPd powder, the excess power 4 [watt] lasted stably for one hour, only less than one gram palladium was consumed. Its cost is lower than the ZrPd powder. We choose the ZrNiPd powder as a good material for the solid fusion.
- (3)The concentration of helium was very successful. These results indicate that the reacted gas of “solid nuclear fusion" can serve as a source of helium production.
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