

JCF2-3

Low Excess Heat Evolution and Impurities  
Production in Light Water Electrolysis

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I . Excess heat measurement  
for light water electrolysis

Cathode: Nickel plate

Nickel-plated iron plate

Anode :  $10 \times 5 \times 0.1$ mm Platinum plate

40 cc 0.5M  $K_2CO_3$  solution

10mm gap spacing

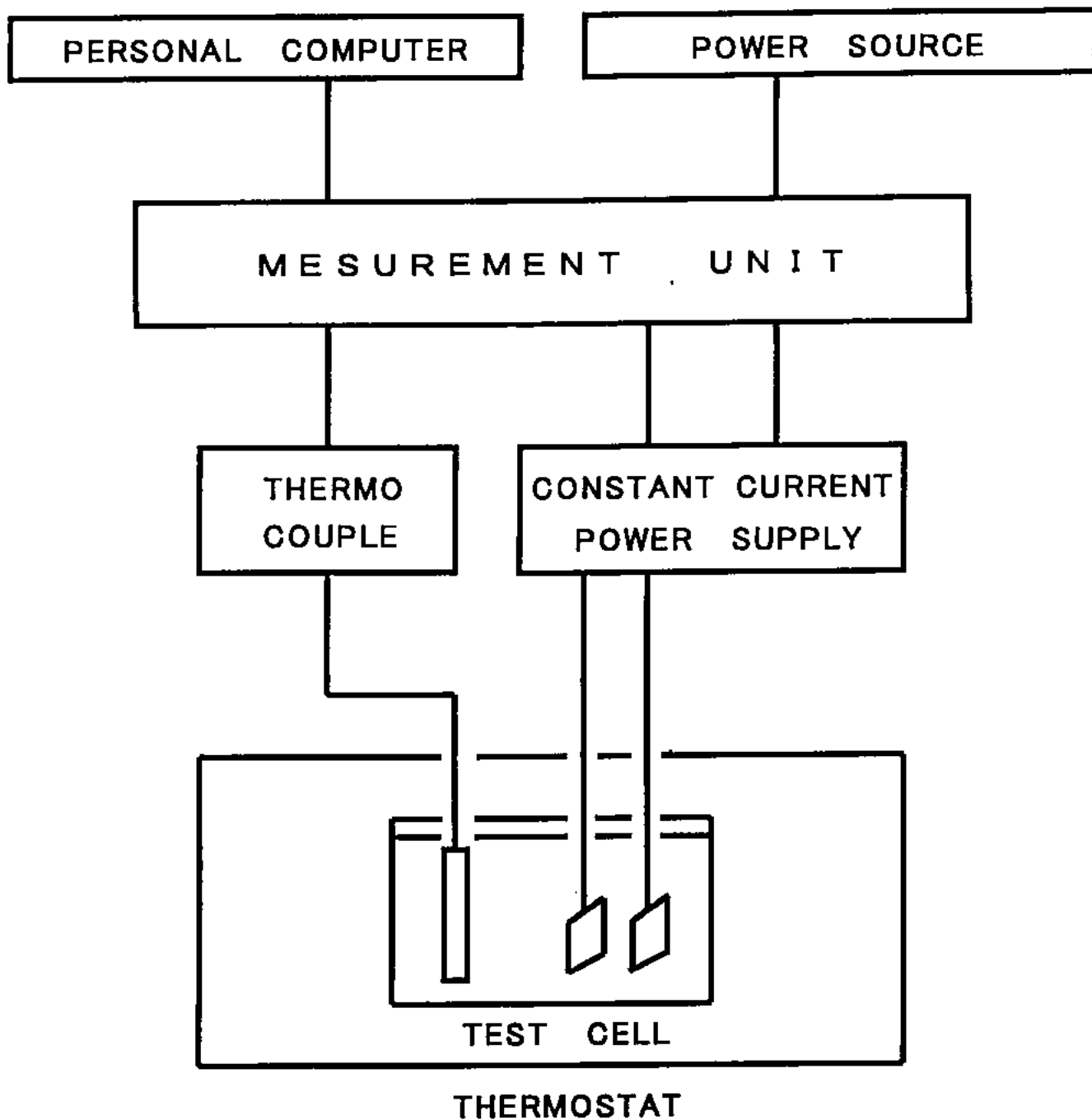
II . Time-of-flight SIMS analysis  
after light water electrolysis

Cathode:  $10 \times 5 \times 0.1$ mm gold plate

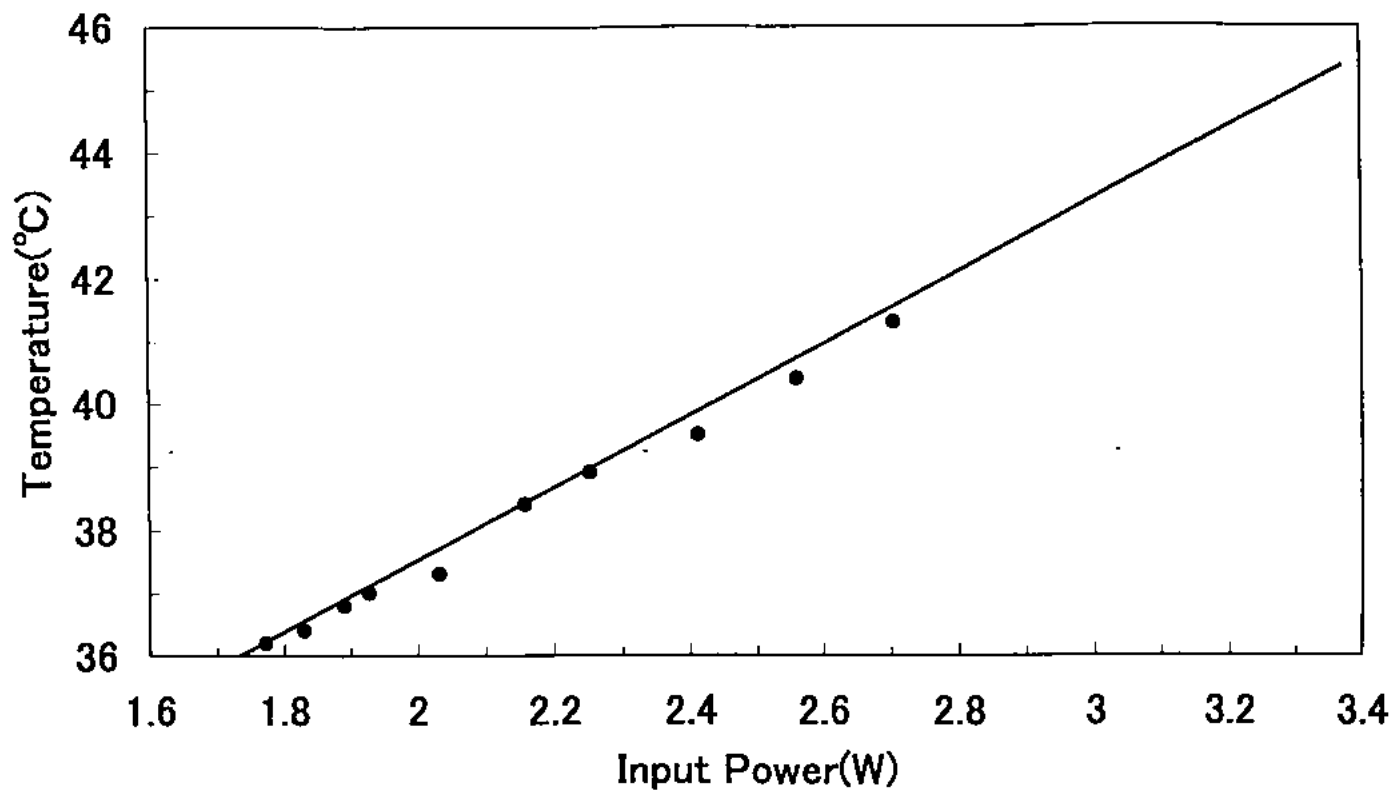
Anode :  $10 \times 180$ mm 80-mesh platinum

150-500 cc 0.5M  $Na_2SO_4$  solution

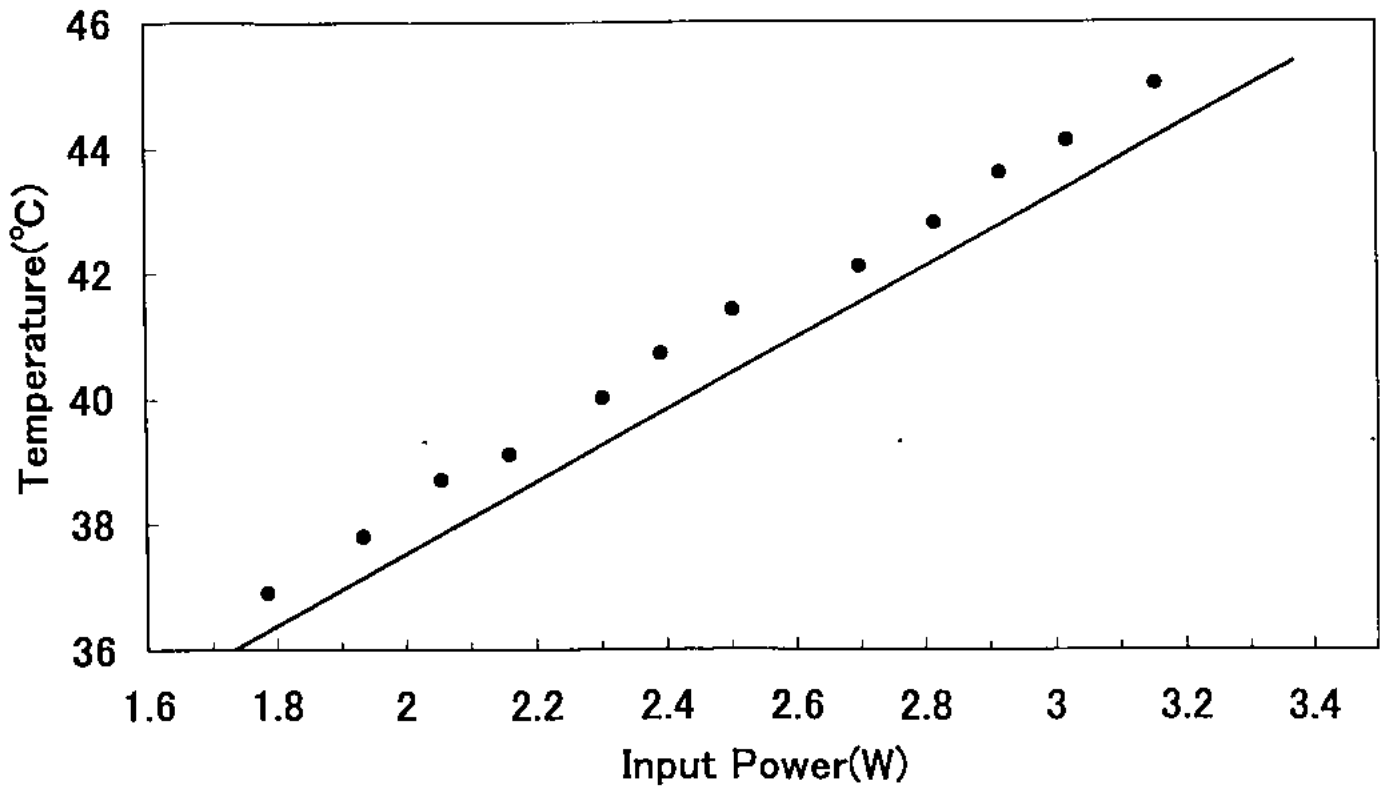
0.5A DC mode for 7-98 days



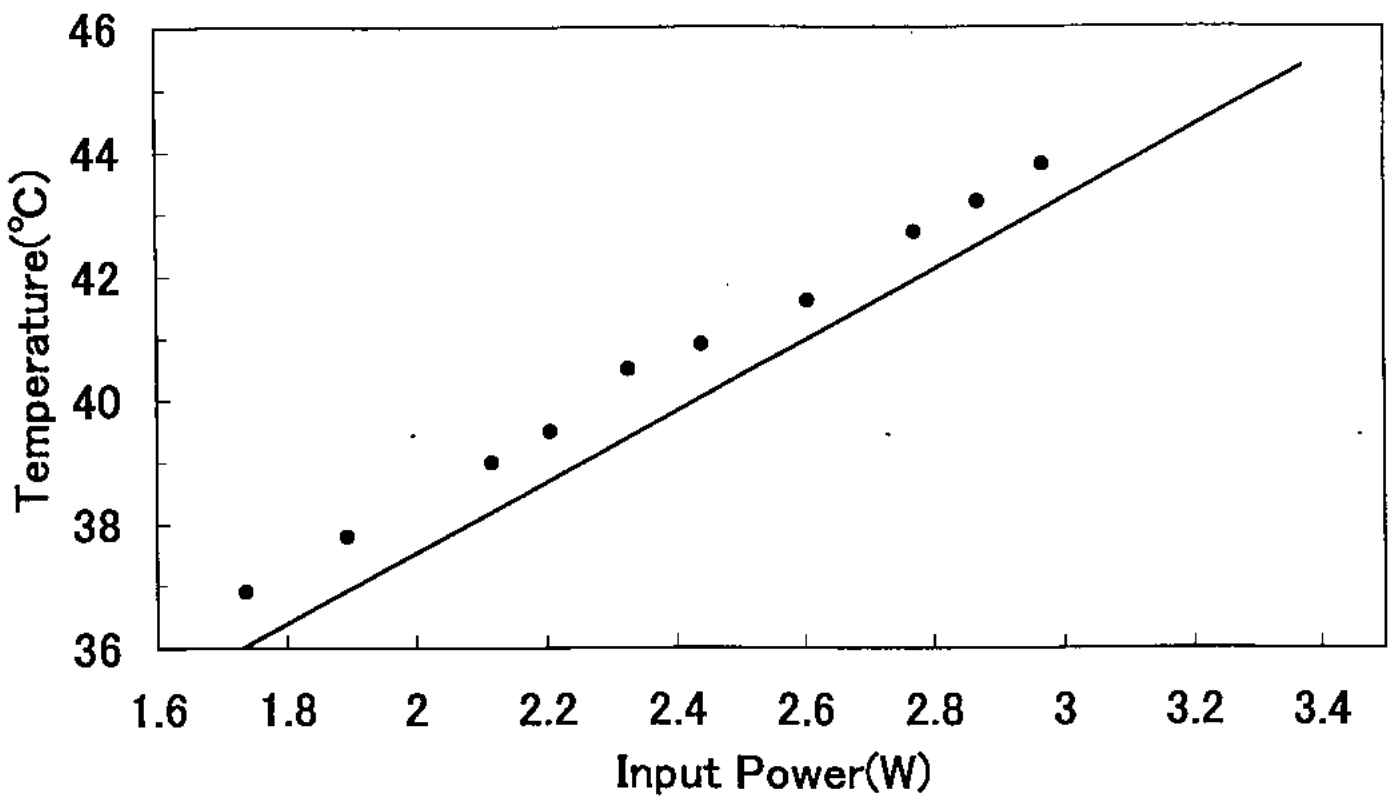
Excess heat measurement system



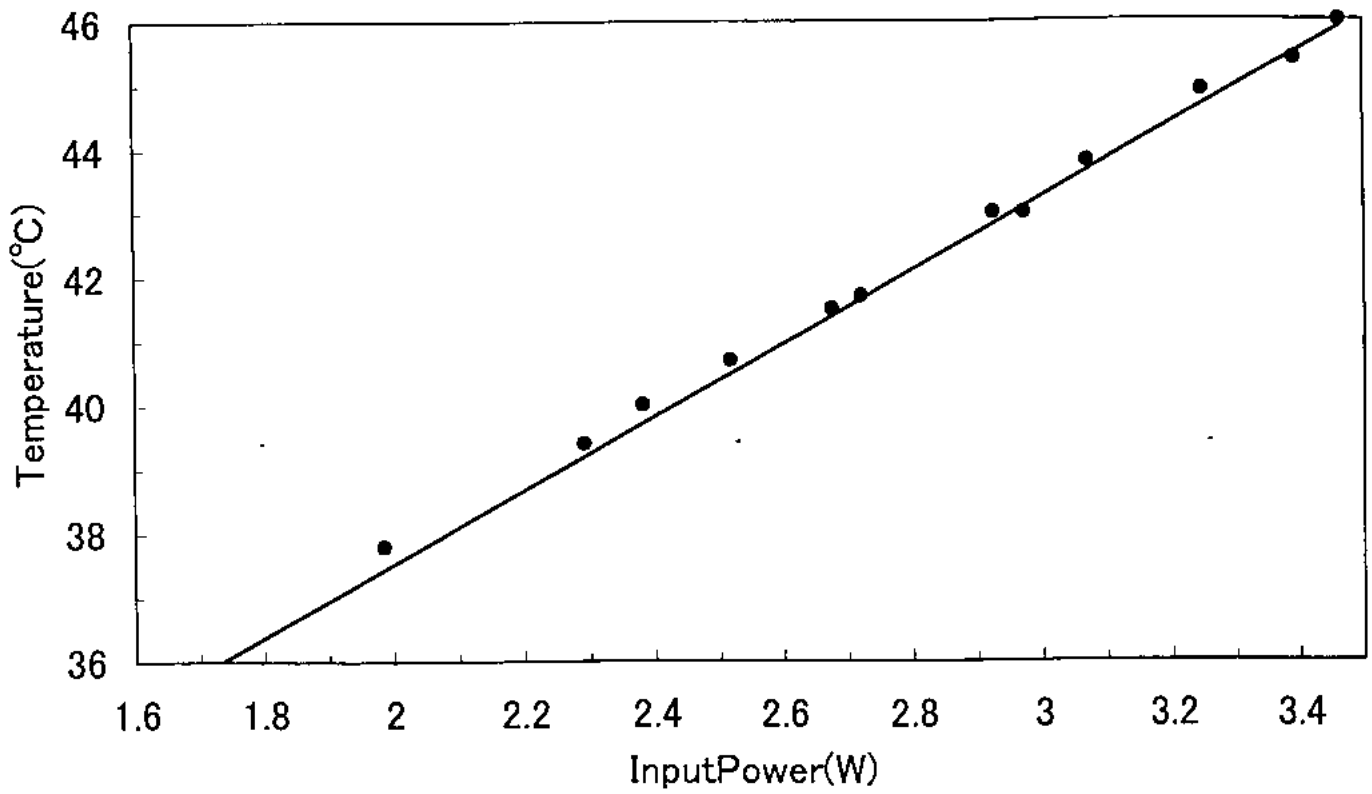
10 × 5 × 0.1mm Plain nickel



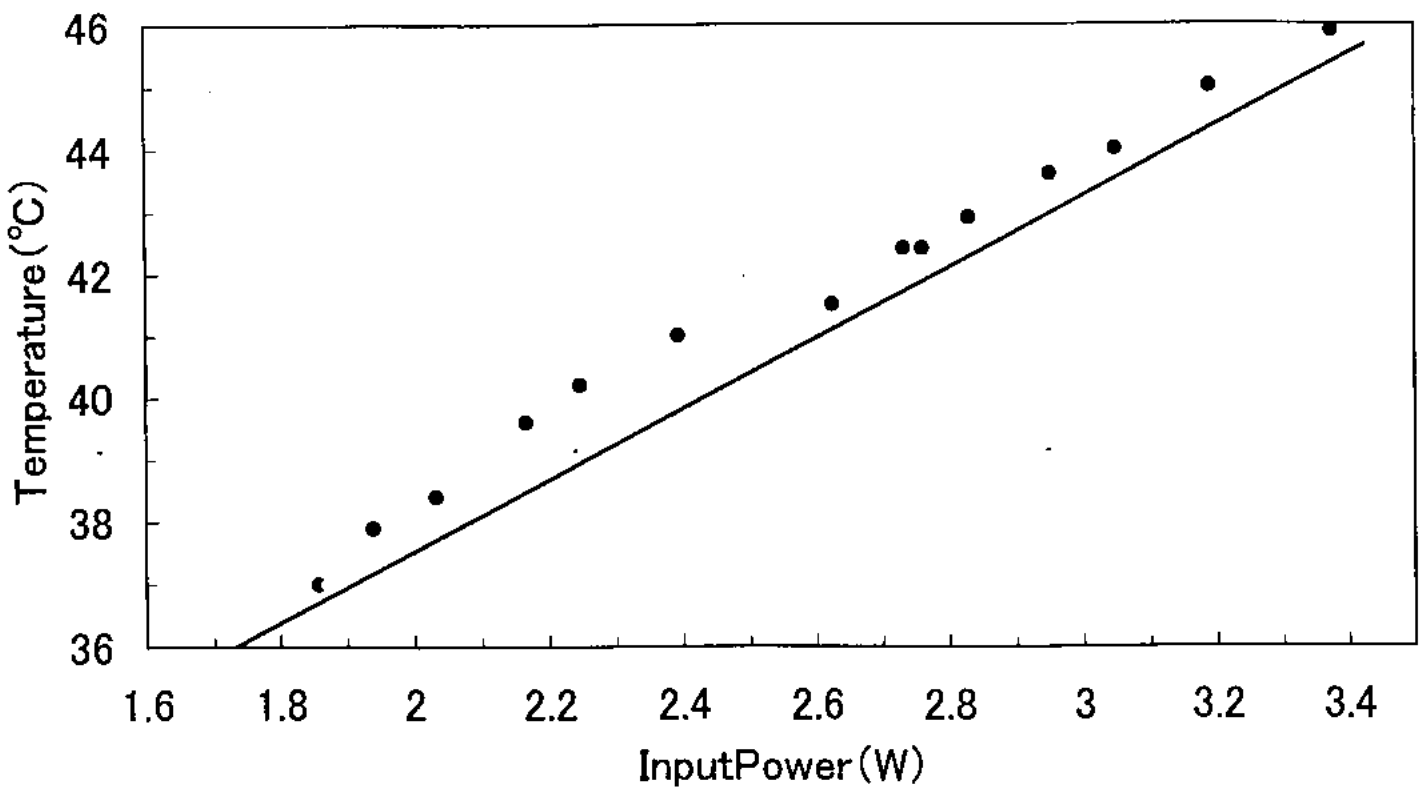
10 × 5 × 0.1mm Scraped nickel



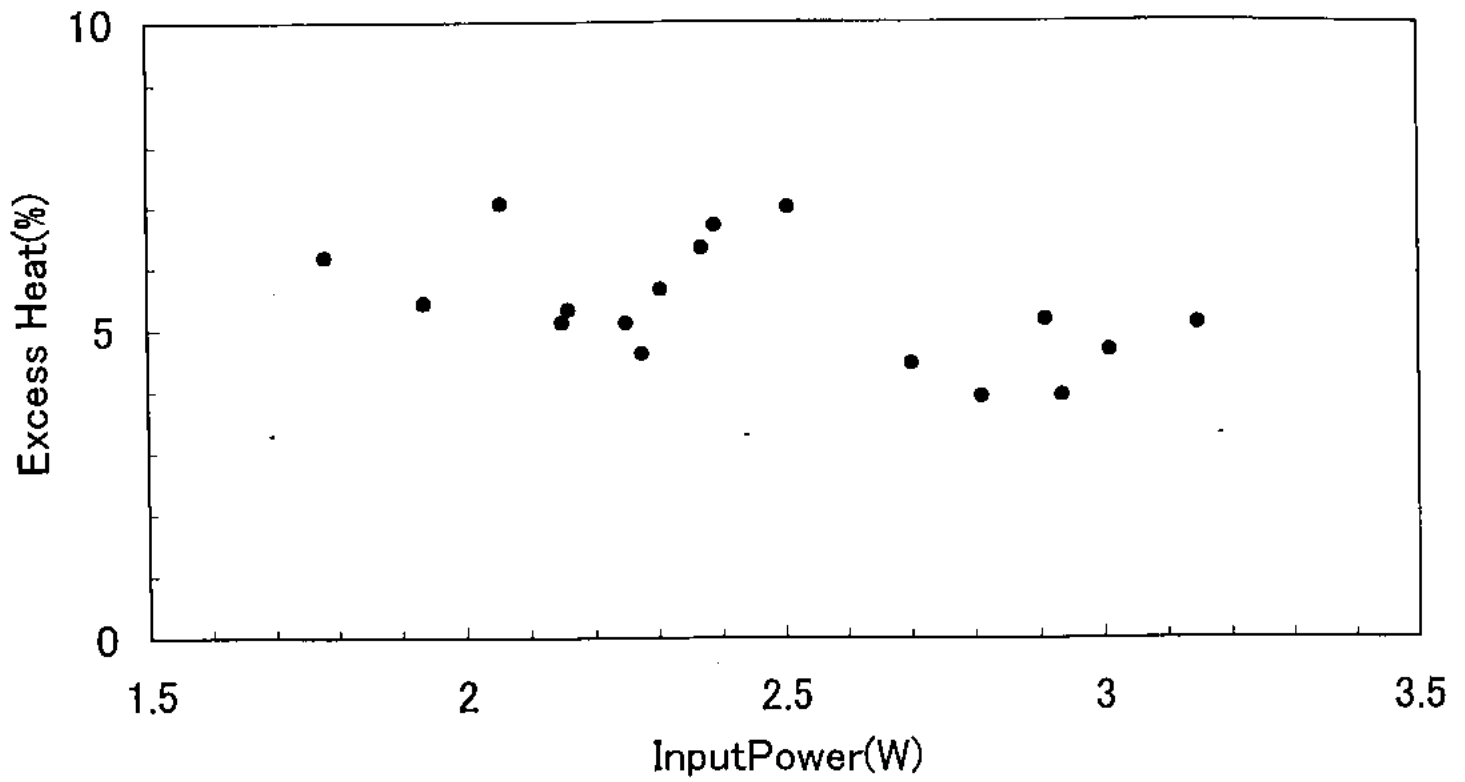
10 × 5 × 0.5mm Nickel-plated iron



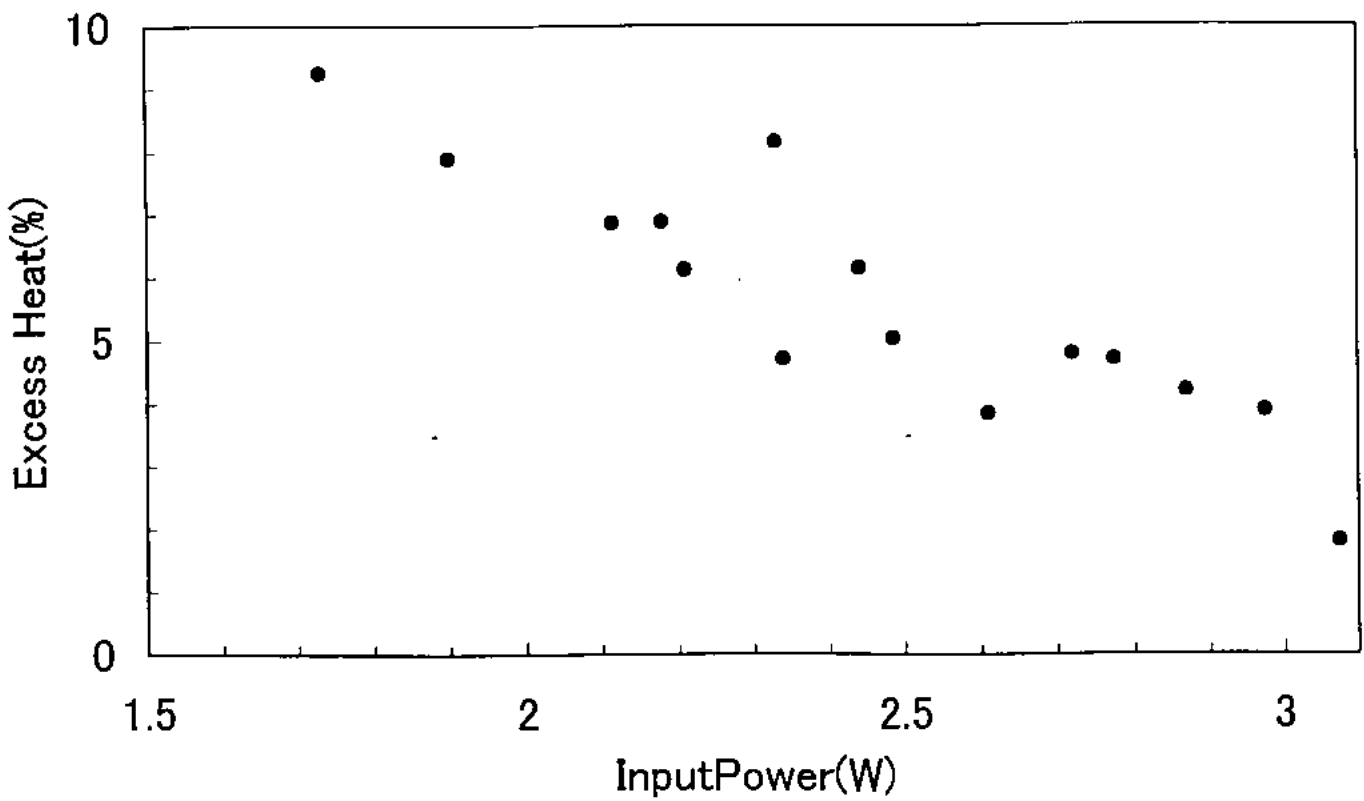
10 × 10 × 0.1mm Plain nickel



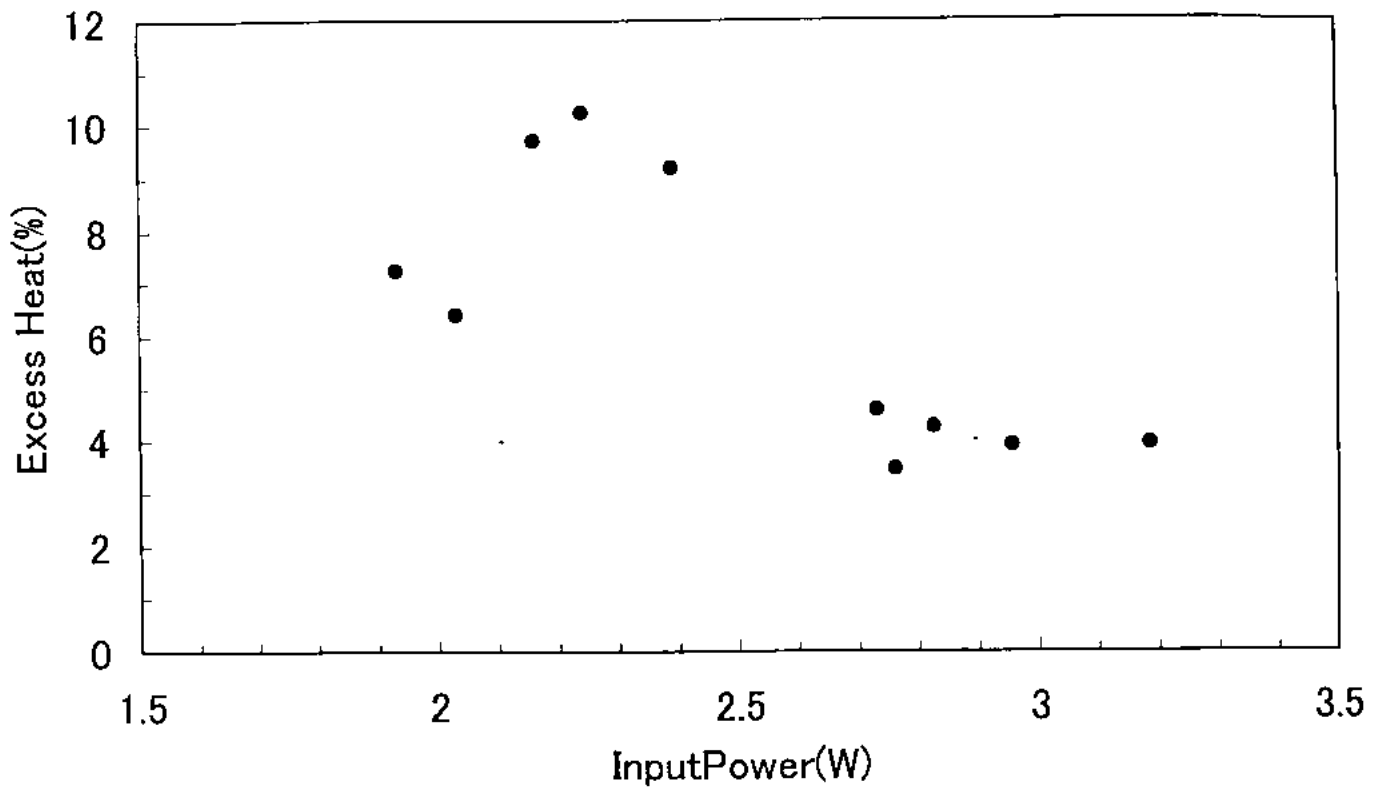
10 × 10 × 0.1mm Scraped nickel



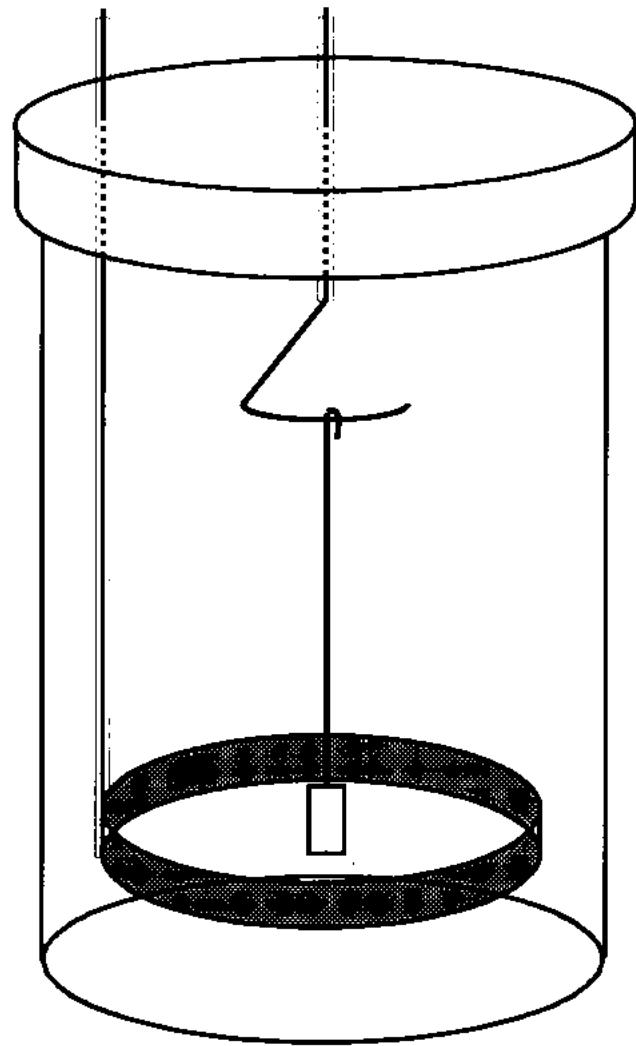
10 × 5 × 0.1mm Scraped nickel



10 × 5 × 0.5mm Nickel-plated iron

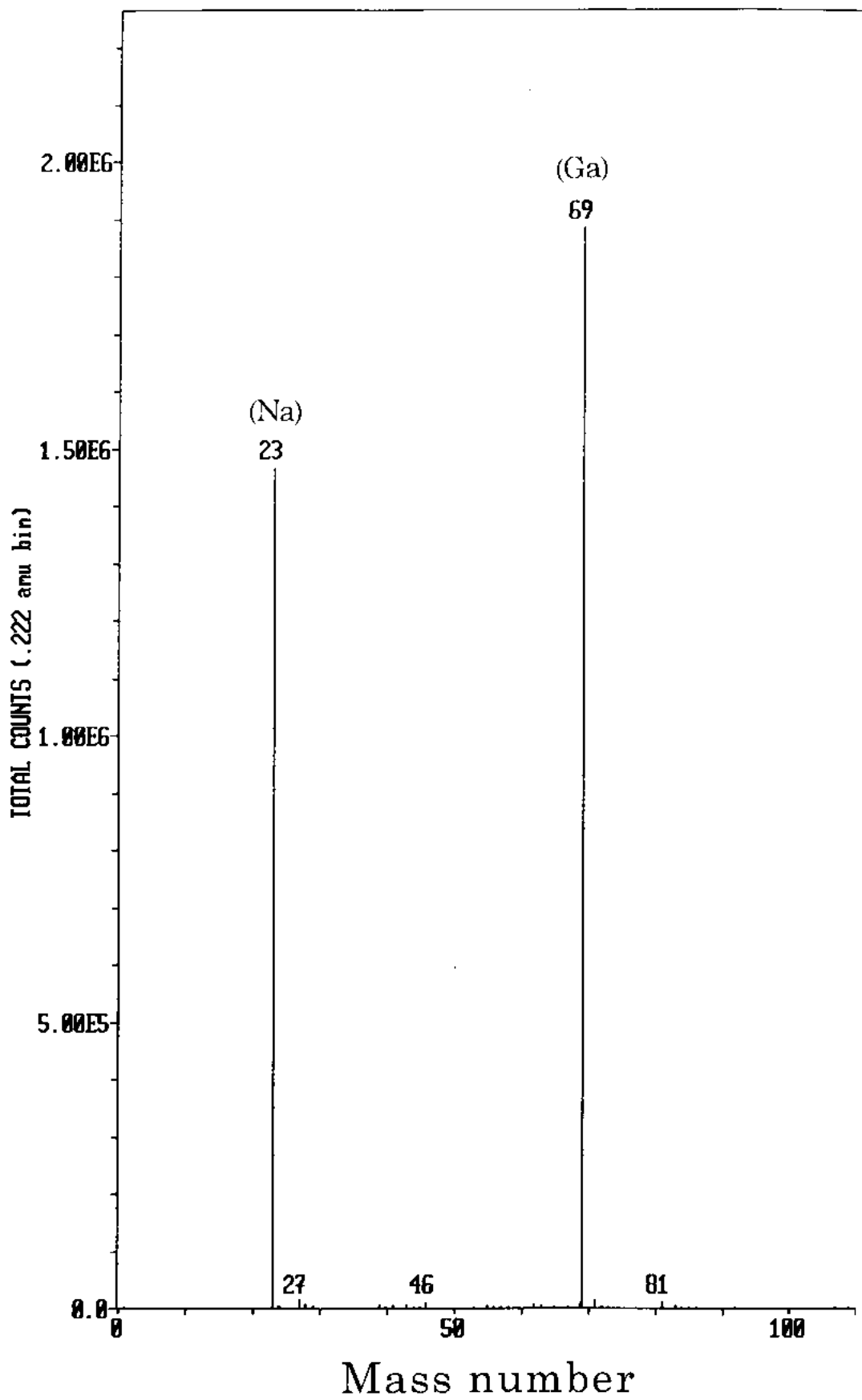


$10 \times 10 \times 0.1\text{mm}$  Scraped nickel

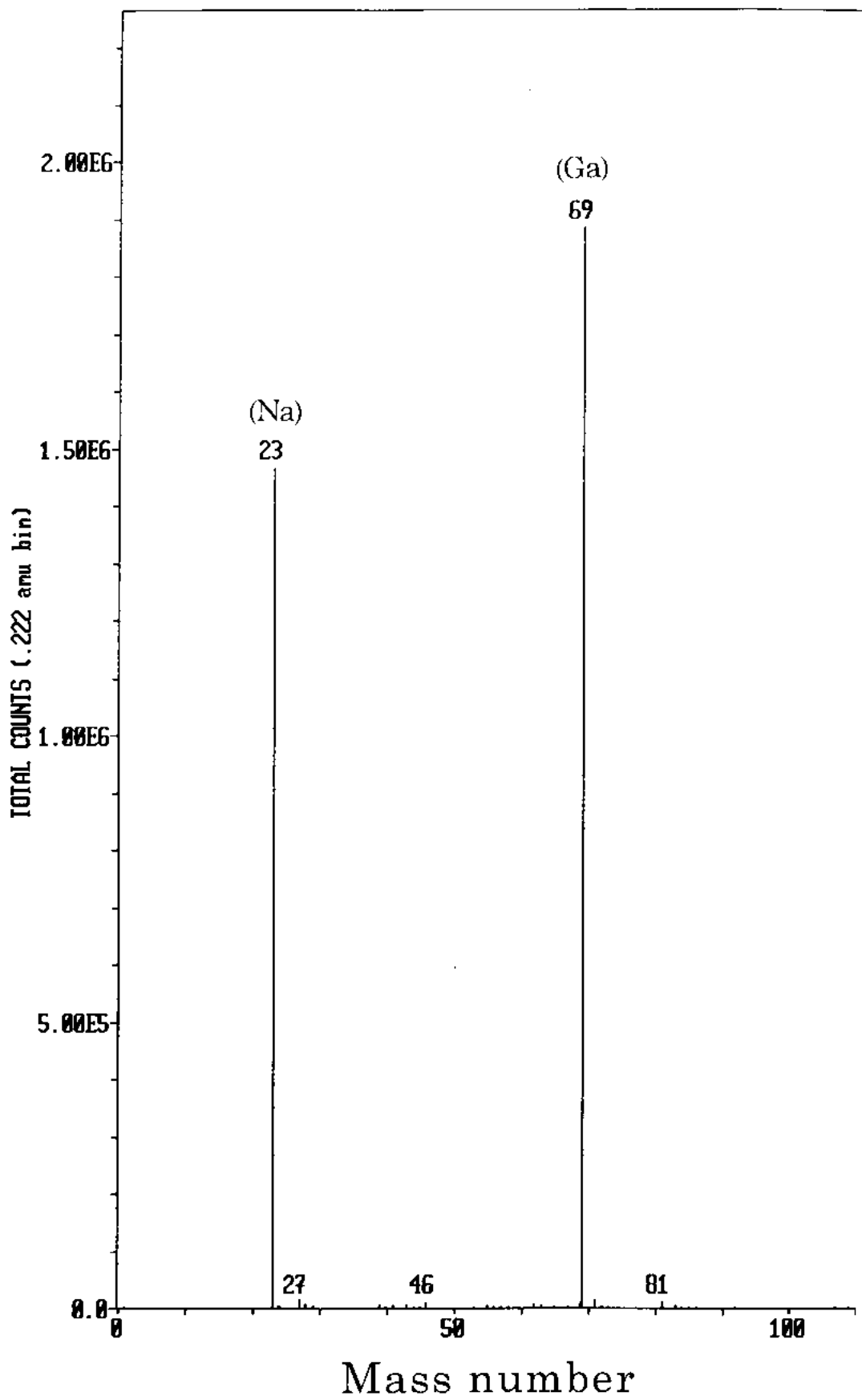


Test cell for TOF-SIMS analysis

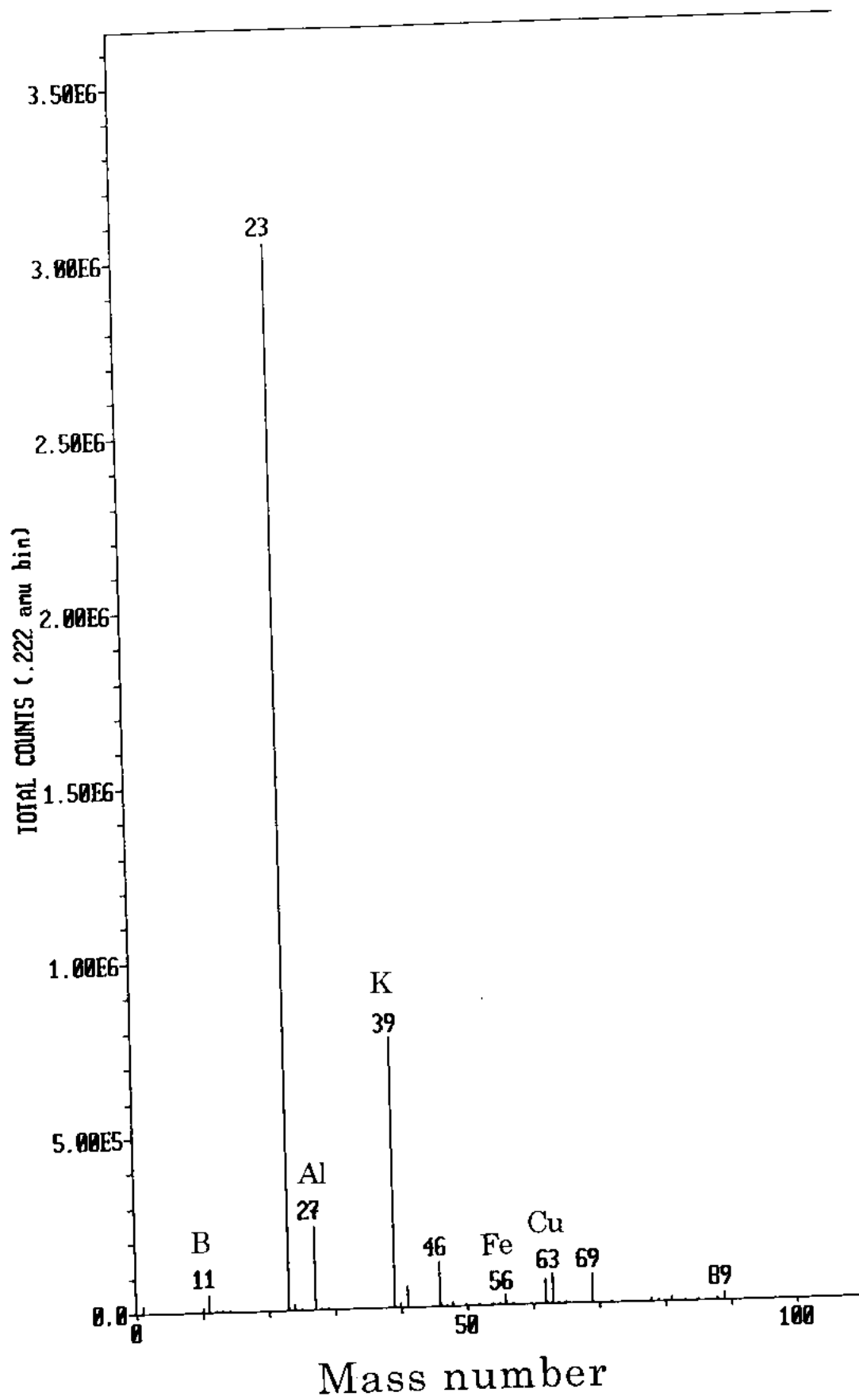




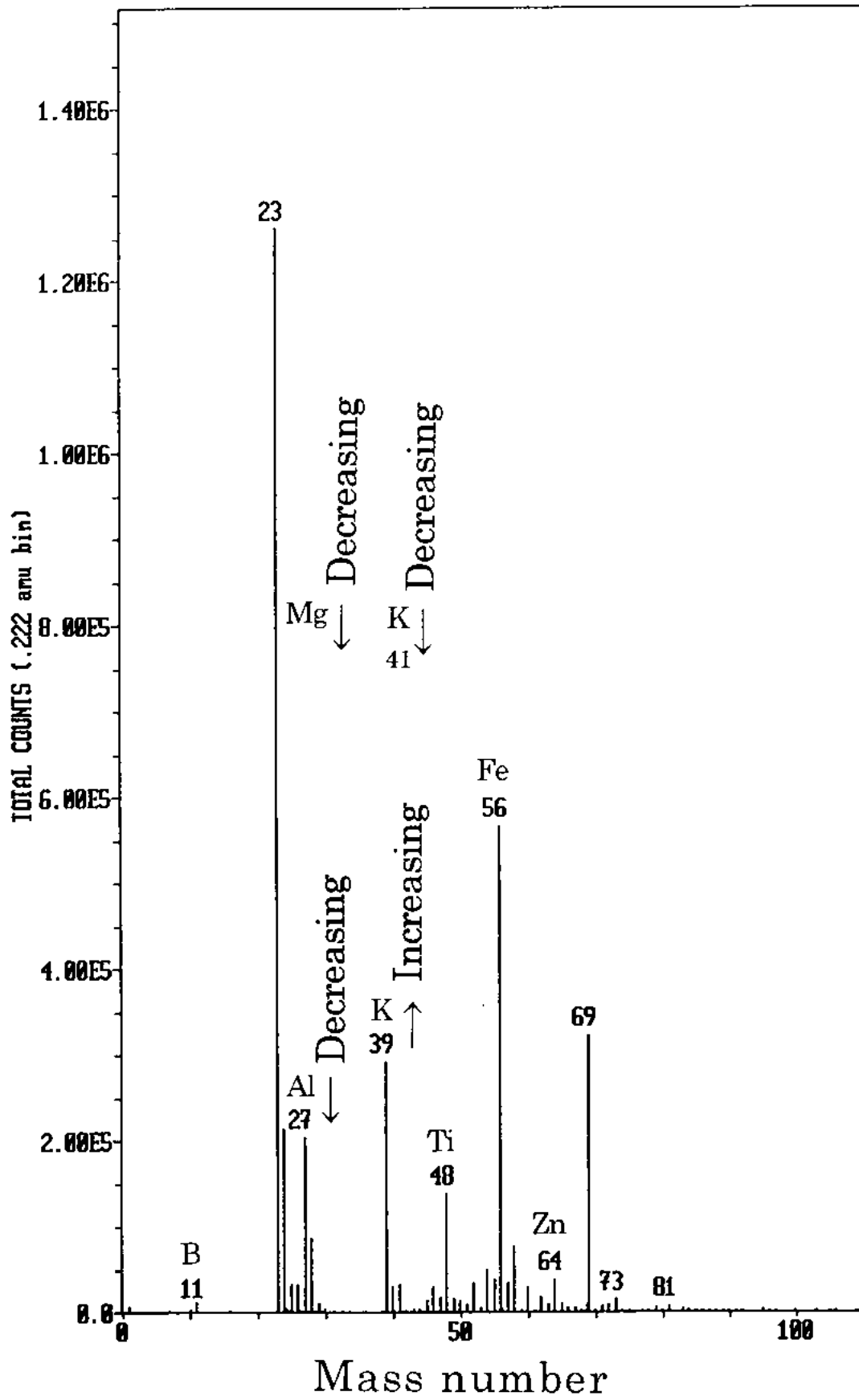
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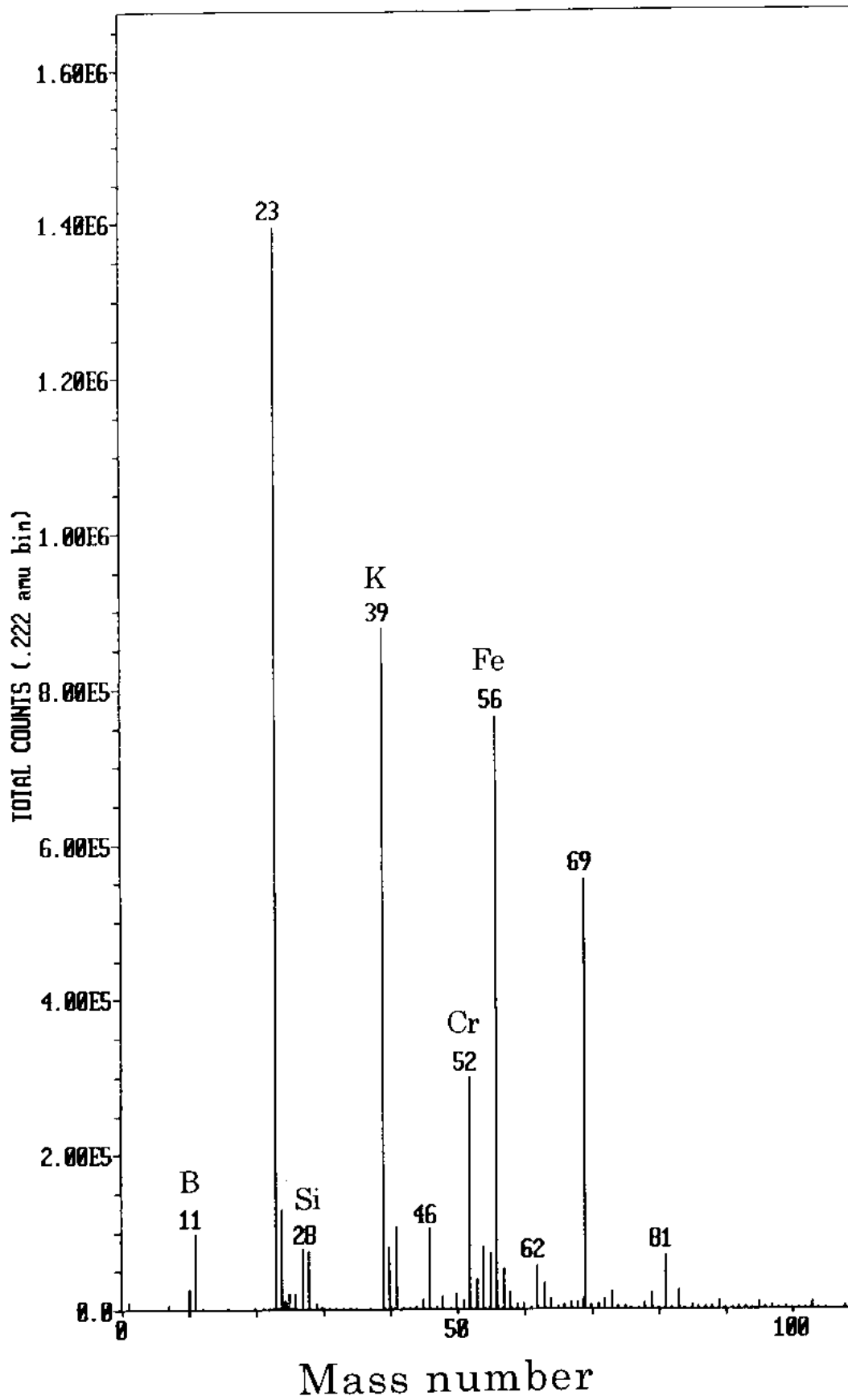
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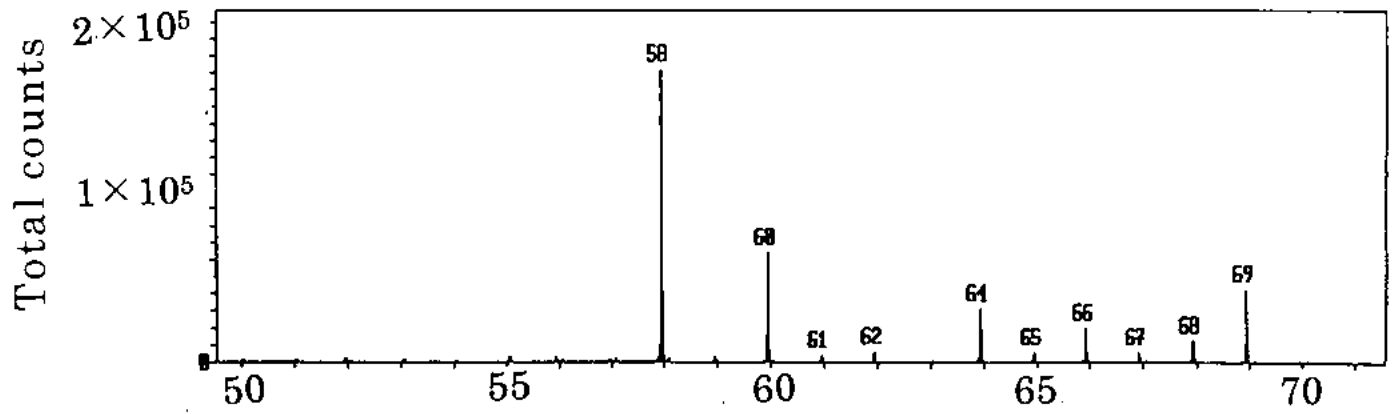
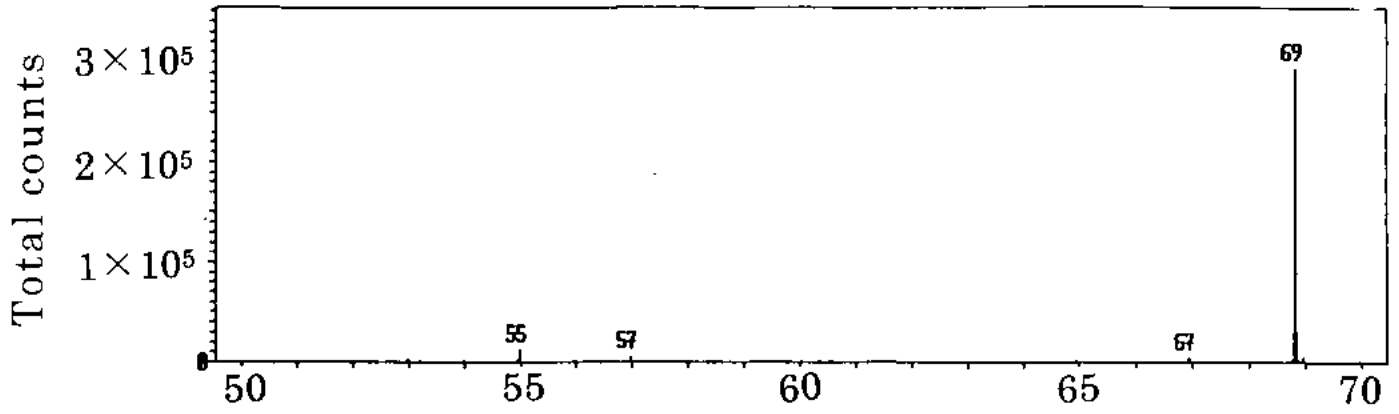
15 days

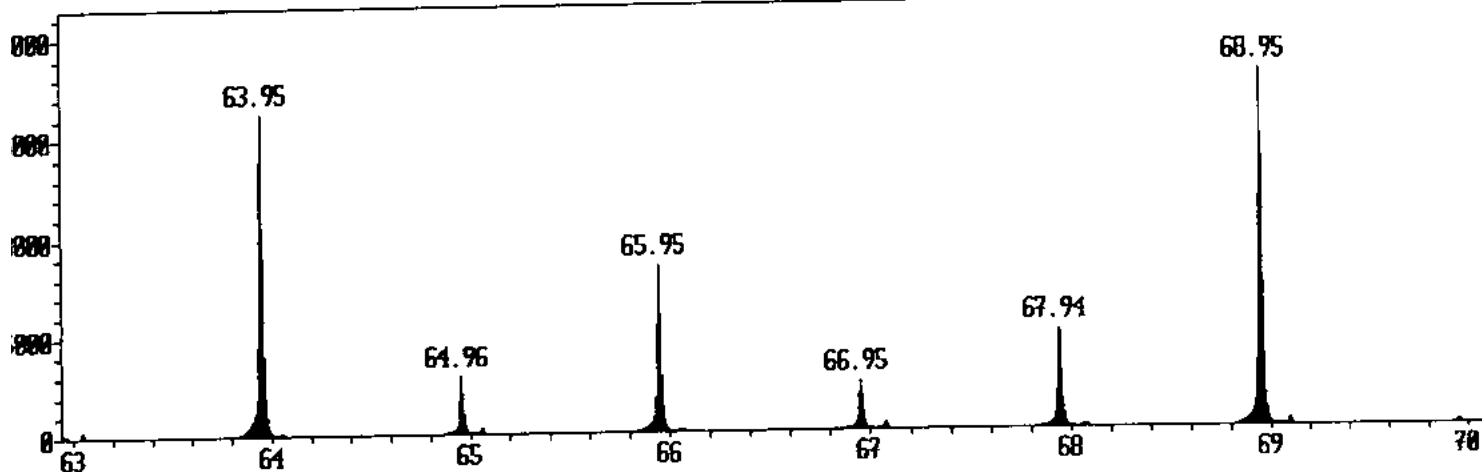


20 days



92 days

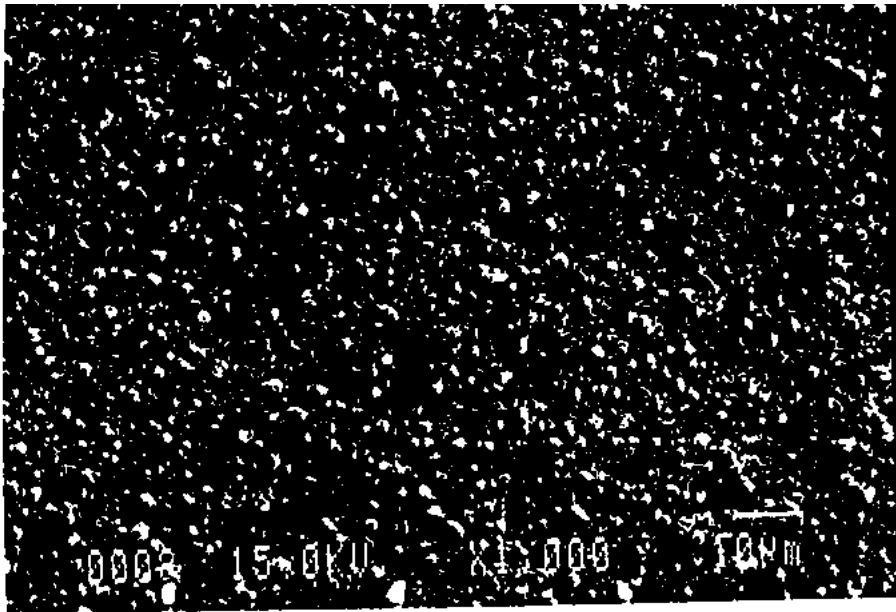




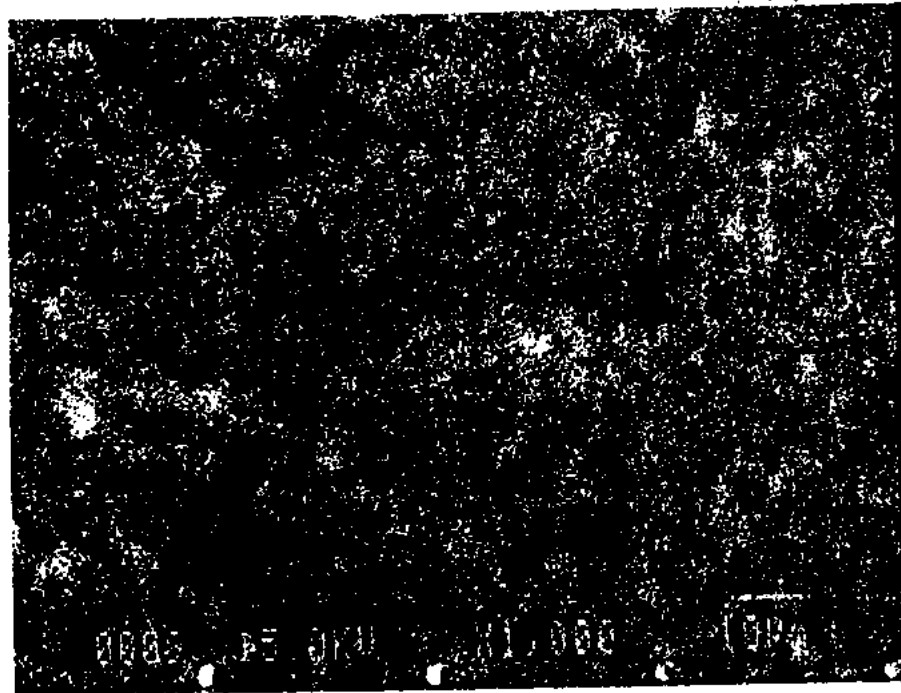
FILE NAME: 9928AU02    DATE : 24 Jan100 15:17    ACQUISITION TIME: 5.0 MIN.    SPECTRUM INTEGRAL : 850152  
 Aq20#, Na2SO4, 0.5M500cc, 0.5A3month.;    Suppter 10s 9928AU01  
 + IONS    PRIMARY GUN: LMIG    TIME RECORDER: Multi-Stop TDC    X-Y SOURCE: Raster    TIME PER CHANNEL:  
 DATA SET: 1 Spectra; 0 Image(s)    RASTER SIZE: 81µm    RASTER TYPE: 81

	Natural (%)	Detected (%)
<sup>64</sup> Zn	48.6	43.6
<sup>66</sup> Zn	27.9	23.1
<sup>67</sup> Zn	4.1	15.3
<sup>68</sup> Zn	18.8	17.2
<sup>70</sup> Zn	0.6	0.7

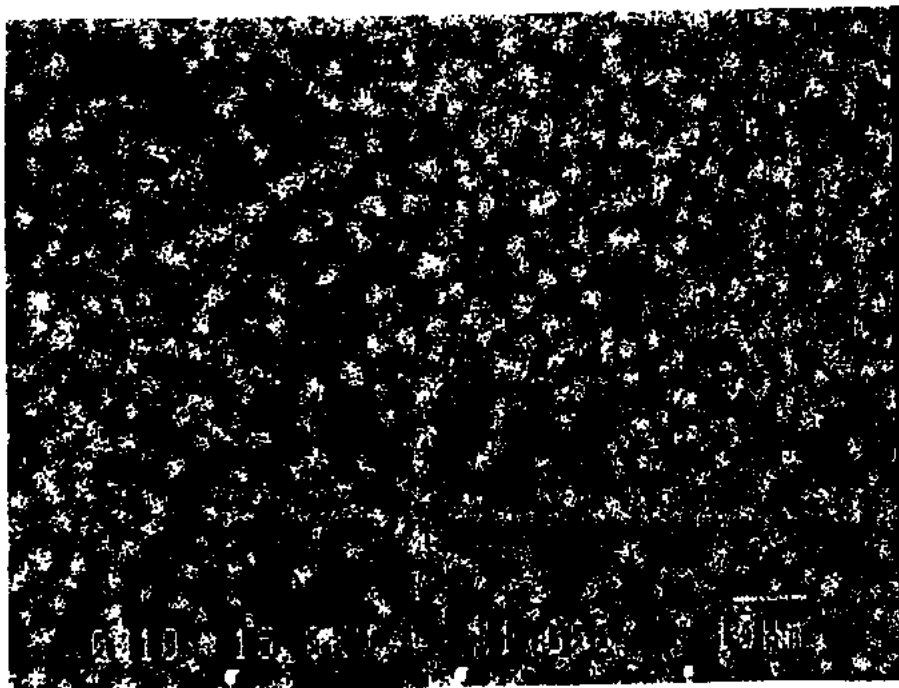
86 days



COMP



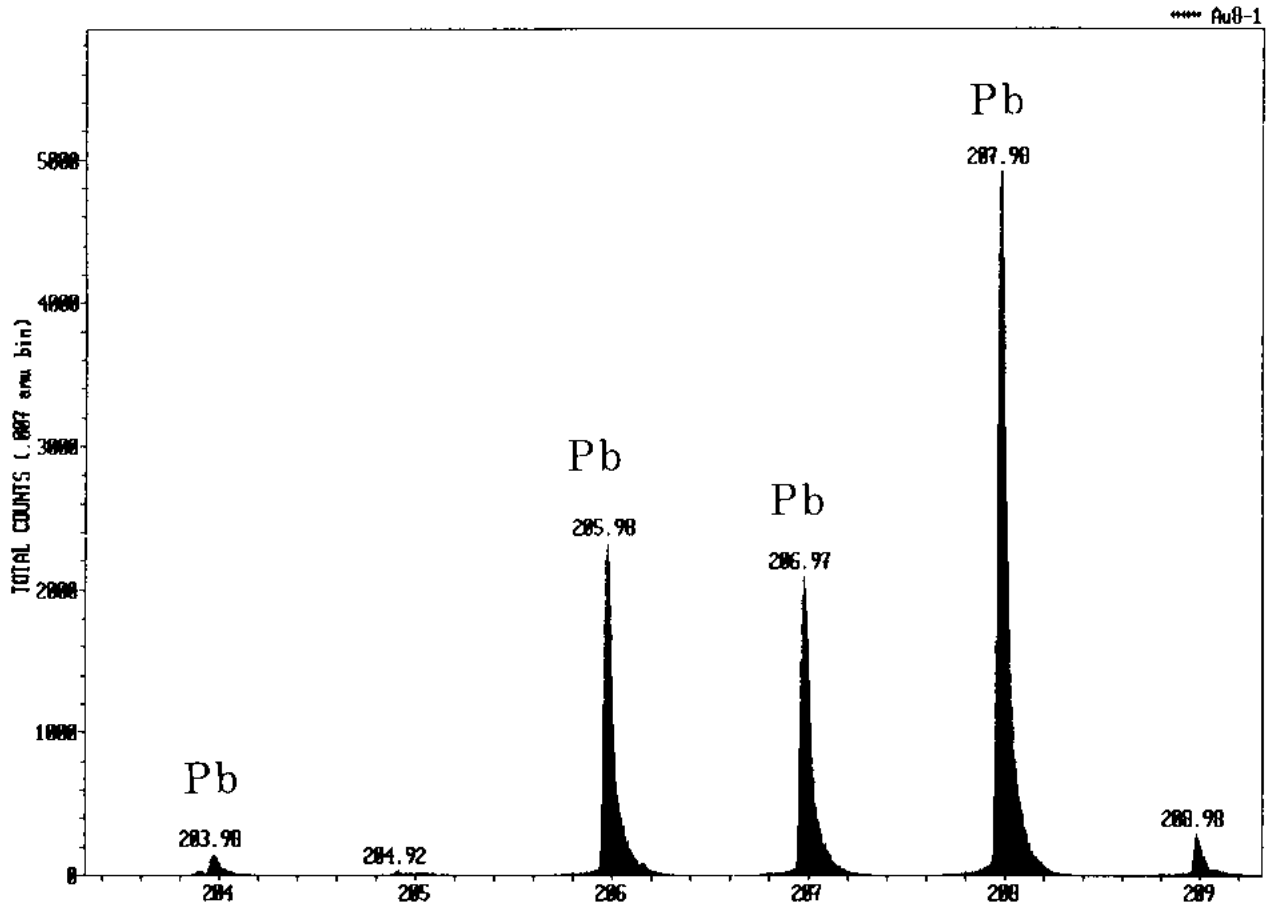
Ni



Zn

EPMA





FILE NAME: Au8-1      DATE : 22 Jan 99 13:42      ACQUISITION TIME: 5.0 MIN.      SPECTRUM INTEGRAL : 4827428  
 Au No.18, 0.5M Na2SO4 CO2 Free;  
 + IONS    PRIMARY GUN: LMIG      TIME RECORDER: Multi-Stop TDC    X-Y SOURCE: Raster    TIME PER CHANNEL: 138 ps  
 DATA SET: 1 Spectra; 1 Image(s)    RASTER SIZE: 81µm    RASTER TYPE: 81

25 days, non sputtered

Sample 0-05AU01

Element	Counts	Detected	Natural
<sup>10</sup> B	49487	27.8%	19.9%
<sup>11</sup> B	173815	72.2%	80.1%
Na	1418480	100%	100%
<sup>24</sup> Mg	138408	79.9%	79.0%
<sup>25</sup> Mg	16881	9.7%	10.0%
<sup>26</sup> Mg	18003	10.4%	11.0%
Al	81593	100%	100%
<sup>28</sup> Si	69059	92.8%	92.3%
<sup>29</sup> Si	2510	3.4%	4.7%
<sup>30</sup> Si	2837	3.8%	3.0%
<sup>39</sup> K	937375	88.7%	93.3%
<sup>41</sup> K	119524	11.3%	6.7%
Na <sub>2</sub>	128099	100%	100%
<sup>50</sup> Cr	9254	1	1
<sup>52</sup> Cr	153602	16.6	19.3
<sup>53</sup> Cr	18575	2	2.2
<sup>54</sup> Cr and/ or <sup>54</sup> Fe	40339		
<sup>56</sup> Fe	429076	19.4	43.3
<sup>57</sup> Fe	22109	1	1
<sup>69</sup> Ga	264000	100%	100%

92 days

Sample 0-05AU07

Element	Counts	Detected	Natural
<sup>10</sup> B	30058	21.5%	19.9%
<sup>11</sup> B	109785	78.5%	80.1%
Na	1326904	100%	100%
<sup>24</sup> Mg	92589	72.0%	79.0%
<sup>25</sup> Mg	22697	17.7%	10.0%
<sup>26</sup> Mg	13290	10.3%	11.0%
Al	101134	100%	100%
<sup>39</sup> k	231059	91.7%	93.3%
<sup>41</sup> k	20926	8.3%	6.7%
<sup>50</sup> Cr	4370	1	1
<sup>52</sup> Cr	70799	16.2	19.3
<sup>53</sup> Cr	16499	3.8	2.2
<sup>54</sup> Cr and/ or <sup>54</sup> Fe	21407		
<sup>56</sup> Fe	263009	2.7	43.3
<sup>57</sup> Fe	97651	1	1
<sup>69</sup> Ga	147774	100%	100%

92 days, non sputtered

Detected elements  
after electrolysis

L    B    Na    Mg    Al

Si    K    Ca    Ti    Cr

Mn    Fe    Ni    Cu    Zn

Rh    Pb

## Conclusion

1. No excess power was measured for plain nickel cathode.
2. Excess power levels of up to 10% was measured for scraped nickel cathode and nickel-plated iron cathode.
3. Marked increase were observed in counts of TOF-SIMS for 17 elements including Pb on the gold plate cathode after electrolysis.
4. Clear increases were observed in the isotopic composition of  $^{41}\text{K}$ ,  $^{57}\text{Fe}$  and  $^{67}\text{Zn}$  from those natural values.
5. TOF-SIMS have shown small change in natural isotopic composition for most elements detected.