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# Determination of Ti metal content and total Ti content by combustion (ignition gain)

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## Basic principle

A weighed sample of titanium metal or hydride powder is mixed with twice the quantity of totally calcined zirconium oxide powder and subjected to combustion in air, with calcining until the weight is constant. The addition of zirconium oxide prevents incomplete oxidation as a result of the sample sintering. The oxygen intake per g of the substance is referred to as the ignition gain or oxidation value, and it is an indicator of metal content; it is quoted as percentage of the original weight. Impurities are disregarded.

## Test procedure

0.5 g of titanium metal or hydride powder and 1 g of fully calcined Zirconium oxide powder are weighed on an analytical balance and placed in a quartz crucible which has been uniformly calcined and cooled in a desiccator. The two powders are mixed thoroughly and ignited by heating with a gas burner. The burner is removed immediately when ignition takes place. After complete calcination and cooling, the contents of the crucible must be thoroughly stirred with a spatula and the crucible then further calcined for 1 hour over a powerful bunsen burner flame, stirring repeatedly. Then calcining is to be continued in a crucible furnace for another hour at 1200°C until the weight becomes constant. After a brief period of cooling in air, the crucible must be allowed to cool down in the desiccator and the contents are weighed.

Before determining the titanium content of the hydride powder the H<sub>2</sub> content must be established. The resulting H<sub>2</sub> content must be allowed for in the calculations.

## Calculation

Ignition gain IG:

$$\begin{aligned} & (\text{Final weight in g} - 1.5) \times 200 & = & \text{IG} \\ & \text{Theoretical, for titanium metal powder} & & 66.8 \% \\ & \text{Theoretical, for titanium hydride powder} & & 60.0 \% \end{aligned}$$

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**Titanium metal powder**      Titanium metal content  
$$\text{IG} \times 1.50 \qquad = \text{\% Ti metal}$$

Total titanium content  
$$\left( \frac{\text{IG}}{100} + 1 \right) \times 60 \qquad = \text{\% total Ti}$$

**Titanium hydride powder**      Titanium metal content  
$$(\text{IG} + \text{\%H}_2) \times 1.50 \qquad = \text{\% Ti metal}$$

Total titanium content  
$$\left( \frac{\text{IG}}{100} + 1 \right) \times 60 \qquad = \text{\% total Ti}$$

### Explanation

$$\text{IG } 66.08 \quad = \quad \left( \frac{79.9}{47.9} - 1 \right) \times 100$$

$$\text{IG } 60.0 \quad = \quad \left( \frac{79.9}{49.92} - 1 \right) \times 100$$

$$\text{Factor } 1.50 \quad = \quad \frac{47.9}{32}$$

$$\text{Factor } 60.0 \quad = \quad \frac{47.9}{79.9} \times 100$$

Edition: May 2001

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