Iron content in iron ore

Fast and accurate analysis according to ISO/TS 2597-4

Summary

Iron ores occur in igneous, transformed, or sedimentary rocks. The most widely distributed iron-containing minerals are oxides, such as hematite (Fe_2O_3), magnetite (Fe_3O_4), or limonite ($FeO(OH) \cdot n\ H_2O$), but carbonates such as siderite ($FeCO_3$) are also important.

The total iron content in iron ore plays a central economic role for mining companies. The higher the iron content in the ore, the more profitable the mining operation. Therefore, a fast and accurate analysis is important to determine the most profitable areas to work.

In this Application Note, the iron determination according to ISO/TS 2597-4 is presented. A sample of iron ore is dissolved in hydrochloric acid at elevated temperatures. Afterwards, the total iron content is determined quickly and accurately by potentiometric titration using the Pt ring electrode and potassium dichromate as titrant.

Configuration

2.905.0010 - 905 Titrando

High-end titrator for potentiometric titration with one measuring interface for use with Dosino dosing systems. up to four dosing systems of the 800 Dosino type; dynamic (DET), monotonic (MET), and endpoint titration (SET); Measurement with ion-selective electrodes (MEAS CONC); Dosing functions with monitoring, Liquid Handling; four MSB connectors for additional stirrers or dosing systems; "iTrode" intelligent electrodes; USB connector; For use with OMNIS Software, tiamo software, or Touch Control unit; Compliance with GMP/GLP and FDA regulations such as 21 CFR Part 11, if required;

2.802.0040 - 802 Stirrer for 804 Ti Stand

Rod stirrer including 6.1909.010 stirring propeller.

2.804.0040 - 804 Ti Stand with stand

Titration stand and controller for 802 Rod Stirrer. The 804 Ti Stand together with the optional 802 Rod Stirrer provides an alternative to the magnetic stirrer. Ti Stand with base plate, support rod and electrode holder.

6.0451.100 - Combined Pt ring electrode
Combined platinum ring electrode for OMNIS with a ceramic pin diaphragm.This electrode is well suited for redox titrations when the pH value varies, e.g.: oxygen content according to Winkler; determination of hydrogen peroxide with KMnO4; diazotization titrations; c(KCl) = 3 mol/L is used as reference electrolyte and storage solution.

6.1110.100 - Pt1000 temperature sensor (installation length 12.5 cm)
Pt1000 temperature sensor (class B) made of glass.This PT1000 temperature sensor is also available under the article number 6.1110.110 with an installation length of 17.8 cm.

Sample and sample preparation

The method is demonstrated for various iron ore samples. The iron ore is milled until the grain size is less than 160 µm.

Experimental

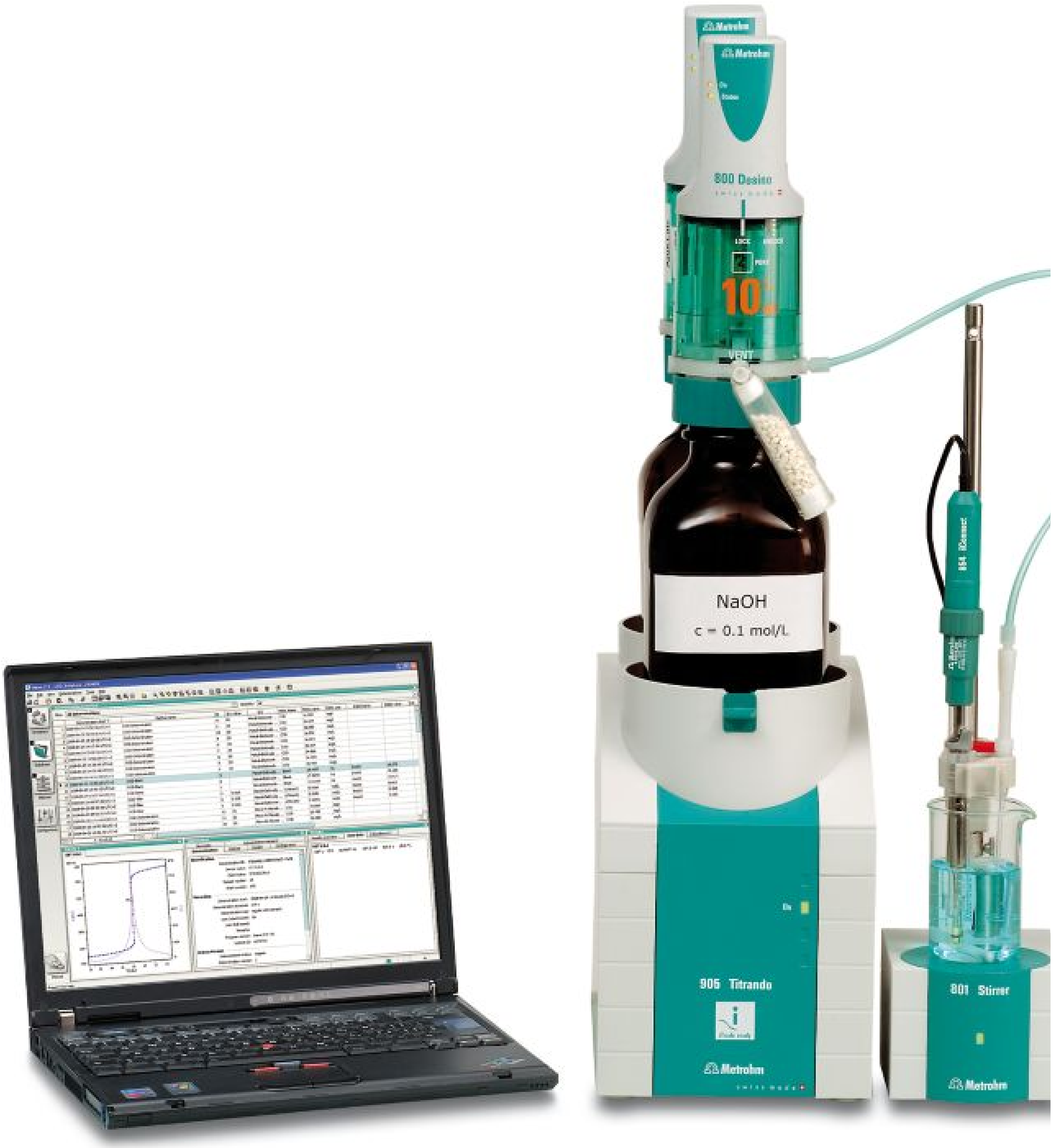

Figure 1. 905 Titrando with tiamo. Example setup for the determination of the iron content in iron ore.

This analysis is carried out on a 905 Titrando equipped with a rod stirrer, combined Pt ring electrode, and temperature sensor. Additionally, a heating plate is needed.

Hydrochloric acid, deionized water, and few drops of tin(II) hydrochloride are added to a reasonable amount of prepared sample. The mixture is heated for one hour at 80 °C, followed by 10 minutes at 95 °C. Afterwards by visual inspection of a color change, iron(III) is reduced with tin(II) chloride, and then titanium(III) chloride is added with an excess, which is then oxidized.

After cooling the sample down to room temperature, deionized water and an acid mixture (phosphoric acid and sulfuric acid) are added. Then the sample is titrated with standardized potassium dichromate until after the equivalence point.

Results

The analysis demonstrates acceptable results and well-defined titration curves. Results are summarized in **Table 1**. An example titration curve is displayed in **Figure 2**.

Table 1. Mean total iron content of various iron ore samples determined with a Titrando system (n = 4).

Sample	Mean	SD(rel) in %
1	65.11%	0.21%
2	54.25%	0.27%
3	62.81%	0.41%
4	66.78%	0.32%
5	66.18%	0.45%

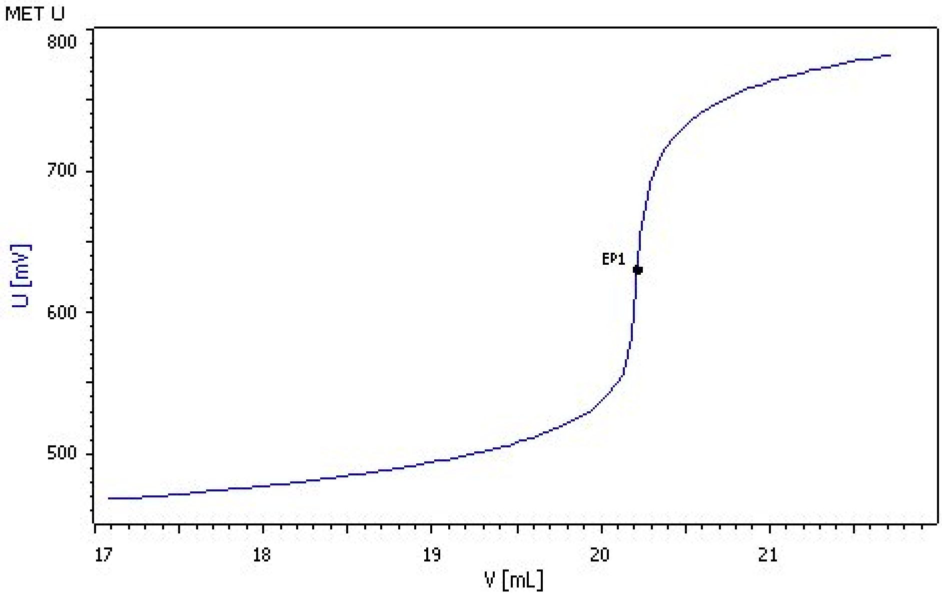

Figure 2. Example titration curve of iron content determination.

Conclusion

After sample preparation, the determination of iron content in iron ores can be performed reliably and cost-efficiently by using a Metrohm autotitrator. Fast and precise determination according to **ISO/TS 2597-4** is possible.

The presented method provides an inexpensive and easily performable approach to estimate if an extraction of iron from iron ore is economically feasible or not.

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