Spectrometer Measurement of Manganese Steel

Overview

(PDF) Determination of Manganese Content in Steel Alloy by. PDF | On Feb 26, 2026, Ajush Dihal published Determination of Manganese Content in Steel Allo.

Key Takeaways

Manganese in steel can be accurately quantified using spectrophotometry by converting manganese to the permanganate ion and measuring its absorbance at 525 nm.

Sample Preparation

Steel samples are first weighed accurately (typically 0. 2–0. 5 g) and dissolved in hot concentrated nitric acid (HNO_3) to release manganese as Mn^{2+} while forming Fe^{2+} and nitrogen oxides.

Nitrogen oxides are removed by boiling and further oxidation is achieved using ammonium peroxydisulfate, which also eliminates organic contaminants. To convert manganese to the spectrophotometrically detectable Mn(VII) state, periodate (KIO_4) is added, often in multiple portions during boiling to ensure complete oxidation.

Spectrophotometric Analysis

Once manganese is in the MnO_4^- form, the solution is diluted to a known volume and measured using a UV-Visible spectrometer. The maximum absorbance wavelength for permanganate ions is 525 nm, and the absorbance of a blank solution (without manganese) is subtracted from the sample readings to correct for background interference.

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Calibration and Quantification

A calibration curve is prepared by measuring the absorbance of standard manganese solutions of known concentrations. The absorbance of the unknown steel sample is then compared to this curve to determine its manganese concentration. The line of best fit from the calibration plot allows calculation of the manganese content in ppm or mass percent.

Volumetric Comparison

In addition to spectrophotometry, volumetric analysis using standardized potassium permanganate ($KMnO_4$) can be performed. The steel sample is titrated against $KMnO_4$, often with ferrous ammonium sulfate as a secondary standard, to cross-validate the manganese content.

Practical Considerations

Ensure accurate weighing of ferromagnetic steel samples by placing the vial on a non-magnetic surface. Avoid oven-drying manganese samples, as this can alter the oxidation state. Maintain absorbance values below 1.

0 for linearity in spectrophotometric measurements. Use duplicate samples to improve reliability and account for experimental variability.

Summary

Spectrophotometric determination of manganese in steel is a reliable method that combines chemical oxidation to Mn(VII), absorbance measurement at 525 nm, and calibration with standard solutions. This approach provides precise quantification of manganese, which is critical for assessing steel properties such as strength, corrosion resistance, and suitability for structural or tool applications.

Article Content

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13: Measuring Manganese Concentration Using Spectrophotometry ...

In this experiment we will determine the quantity of manganese using visible absorption spectroscopy. Because the wavelengths of light we will use are in the visible portion of the

Manganese Determination in Steel Analysis

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This document describes a method for determining the manganese content in steel using spectrophotometry. A spectrophotometer is used to measure the absorbance of the samples after

Manganese Analysis in Steel by Spectroscopy

This document describes an experiment to determine the concentration of manganese in steel samples using visible spectroscopy. Steel samples were dissolved in aqua regia and oxidized to form purple

Spectrophotometric Determination of Manganese in Steels by On-Line ...

The aim of this work is to propose a flow spectrophotometric procedure for manganese determination in steel based on electrochemical oxidation of Mn (II) to Mn (VII) at a Pt electrode...

Determination of manganese in submerged steel using Fraunhofer

In this work, we have measured ten submerged steel samples using the LS-DP-LIBS method. Based on the Fraunhofer-type signals, the manganese concentrations in the steel samples

Lab 6 – Chemistry 262 – Quantitative Analysis

Spectrophotometric Determination of Manganese in a Sample of Steel In this experiment, the mass percent of manganese in a sample of steel is determined by a spectrophotometric method.

COLORIMETRIC DETERMINATION

This analysis is accomplished by dissolving the steel sample, converting all of the manganese to the intensely colored MnO4- ion, and then determining the percentage of light absorbed by the MnO4-

Precise determination of manganese in steel by dc glow discharge ...

A voltage modulation technique was applied for the precise and accurate determination of manganese in steels in dc glow discharge optical emission spectrometry. Emission signals from the

The determination of manganese in iron and steel by atomic absorption ...

A procedure is described for the determination of 0.001–2% of manganese in low and high alloy irons and steels by atomic absorption spertrophotometry. The sample is dissolved in phosphoric-sulphuric

Simultaneous Determination of Manganese and Nickel in Steel by ...

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To simultaneously determine the mass percentages of nickel and manganese in a sample of steel powder. To become familiar with the operation of an inductively coupled plasma atomic emission

Improved Analysis of Manganese in Steel Samples Using Collinear

Abstract A long–short double pulse laser-induced breakdown spectroscopy (long–short DP-LIBS) method was employed to improve the analytical performance of LIBS for the measurement

Determination of Manganese in Steel

Experiment IX Determination of Manganese in Steel By Spectrophotometric Method 1-Objectives: • To measure the concentration of a solute by its absorbance of light. • To learn how to

Colorimetric Manganese Analysis in Steel | PDF | Absorbance ...

This document describes the process of determining the percentage of manganese in a steel sample using colorimetric analysis. It involves dissolving the steel sample, converting all the manganese to

Standard Test Method for Analysis of High Manganese Steel by Spark ...

Scope 1.1 This test method covers the analysis of high manganese steel by spark atomic emission spectrometry for the following elements in the ranges shown: ... Note 1: The ranges

Portable Instrument for the determination of Manganese in Steel

Method for the determination of manganese in steel is based on the permanganate violet color formation due to oxidation of Mn (II) to Mn (VII) having absorbance maxima at 525nm.

Spectrophotometric Determination of Manganese in

Helpful Hints for the Spectrophotometric Determination of Manganese in Steel by Oliver Seely This Web page offers supplementary material to that found in the

Colorimetry for Manganese Content in Steel (LAB 7)

LAB 7: Determination of Manganese content of Steel using Colorimetry Aim: To determine the absorbance of Manganese in steel using colorimetry.

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