Application Note AN-V-179

Iron in boiler feed water

Straightforward, sensitive, and cost-efficient determination using adsorptive stripping voltammetry (DHN method)

The iron concentration in boiler feed water must be monitored to ensure reliable and safe operation of the water-steam circuit in thermal power plants. Iron ions, even in low concentrations, are an indicator for corrosion and therefore can signal potential safety issues. Various guidelines set limits for the maximum iron content in boiler feed water.

The concentration of total iron in boiler feed water can be determined with high sensitivity using adsorptive stripping voltammetry (AdSV) using 2,3-dihydroxynaphthalene (DHN) as complexing agent. Concentrations of total iron in water samples can be determined down to approximately 0.1 µg/L with this method.

The AdSV method is simple to perform, specific, and free of interferences. It is a viable, less sophisticated alternative to atomic absorption spectroscopy (AAS) or inductively coupled plasma (ICP) requiring only a moderate investment in hardware and low running costs.

SAMPLE

Boiler feed water

EXPERIMENTAL

The water sample, DHN solution, and the buffer solution are pipetted into the measuring vessel. The determination of total iron is carried out with an 884 Professional VA using the parameters specified in Table 1. The concentration is determined by two additions of an iron standard addition solution.

Figure 1. 884 Professional VA.

Table 1. Parameters for adsorptive stripping voltammetric (AdSV) analysis of Fe in boiler feed water

Parameter	Setting
Working electrode	HMDE
Mode	DP – Differential Pulse
Deposition potential	-0.1 V
Deposition time	30 s
Start potential	-0.2 V
End potential	-1.2 V
Peak potential Fe	-0.7 V

ELECTRODES

- Working electrode: Multi-Mode Electrode pro with standard glass capillaries
- Reference electrode: Ag/AgCl/KCl (3 mol/L) reference electrode with electrolyte vessel. Bridge electrolyte: KCl (3 mol/L)
- Auxiliary electrode: Platinum rod electrode

RESULTS

The determination of total iron in boiler feed water samples can be carried out in a simple and straightforward manner with adsorptive stripping voltammetry (AdSV).

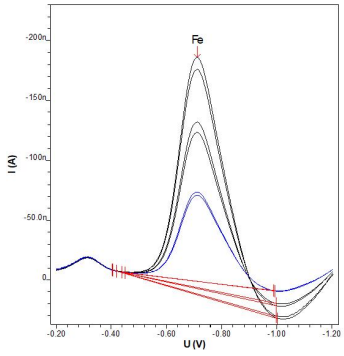

Figure 2. Determination of total Fe in boiler feed water.

Table 2. Results of total Fe determination with the 884 Professional VA

Sample	Total Fe [µg/L]
Boiler feed water	3.0

Internal reference: AW VA CH4-0513-072012

CONTACT

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CONFIGURATION

884 Professional VA semiautomated for MME

884 Professional VA semi-automated for MME is a convenient high-end routine analyzer for trace determinations with voltammetry and polarography with the Multi-Mode Electrode pro or the scTRACE Gold. The proven Metrohm electrode methods in combination with a completely new design of potentiostat/galvanostat and the extremely high-performance viva software opens up new perspectives for the determination of heavy metals. The potentiostat with a certified calibrator readjusts itself automatically before each measurement, thus guaranteeing maximum precision.

Determinations with rotating disc electrodes can also be performed with the instrument, e.g. determinations of organic additives in electroplating baths with "Cyclic Voltammetric Stripping" (CVS), "Cyclic Pulse Voltammetric Stripping" (CPVS), and chronopotentiometry (CP). The replaceable measuring head enables rapid changes between various applications with different electrodes.

Two 800 Dosinos (supplied) permit the automatic addition of auxiliary solutions during the determination, e.g., electrolyte, buffer or standard solutions.

The viva software is required for control, data acquisition, and evaluation.

The 884 Professional VA semi-automated for MME is supplied with extensive accessories and a measuring head for the Multi-Mode Electrode pro. Electrode set and viva license need to be ordered separately.

VA electrode equipment with Multi-Mode Electrode pro for Professional VA instruments

Complete electrode set for polarographic and voltammetric determinations. Includes Multi-Mode Electrode pro, reference electrode, platinum auxiliary electrode, measuring vessel, stirrer, electrolyte solution and additional accessories for setting up and operating the Multi-Mode Electrode.