Benefits of a vertically oriented torch—fast, accurate results, even for your toughest samples

Technical Overview

5110 ICP-OES

Introduction

One of the main considerations when running samples on an ICP-OES is the percentage of total dissolved solids (TDS) in the sample. Many common sample types can contain high levels of TDS, such as soil, sludge and brine samples analyzed in environmental labs, as can various acid digests and fusions analyzed in minerals, mining, and soil labs.

The level of TDS in a sample will often dictate which type of ICP-OES instrument is used for the analysis. As a guide, samples with up to 3% TDS are routinely analyzed using an ICP-OES instrument with a horizontal torch, while samples with higher levels of TDS are typically run on a radial instrument with a vertical torch. Other key considerations when running high TDS samples are a robust RF system and a torch that is capable of running challenging samples.

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The benefits of a vertical torch

While radial instruments with a vertical torch can handle higher levels of TDS, the radially viewed plasma (when the plasma is viewed from the side of the torch) is not capable of reaching the detection limits that an axially viewed plasma (viewed from the end of the torch, down the central channel of the plasma) can achieve. Where lower detection limits are required, instruments with a horizontal torch can be equipped with a specially designed high solids torch that is capable of handling higher levels of TDS. However the precision and long term stability of such systems is reduced compared to a vertical torch, and the torch must be cleaned or replaced at more regular intervals.

Agilent's 5110 ICP-OES includes a robust vertical torch in all three available configurations of the instrument. The Synchronous Vertical Dual View (SVDV) configuration is four instruments in one; able to run in axial, radial, vertical dual view and synchronous vertical dual view modes. The SVDV configuration features unique Dichroic Spectral Combiner (DSC) technology that enables the fastest analyses and the lowest gas usage (Figure 1). The Vertical Dual View (VDV) configuration offers high throughput, and is upgradable onsite to the SVDV configuration if sample throughput demands increase. The 5110 is also available in a Radial View (RV) configuration, which is ideal for labs needing a fast, high performance radial ICP-OES. Measurement modes available on each configuration can be seen in Table 1.

Table 1. The Agilent 5110 is available in three configurations, all featuring a vertical torch. Available viewing modes for each configurations are summarized below.

	Radial Mode	Axial Mode	VDV Mode	SVDV Mode
SVDV configuration	✓	✓	✓	✓
VDV configuration	✓	✓	✓	
RV configuration	✓			

A vertical torch allows the analyst to measure the most challenging samples, from high matrix to volatile organic solvents. The vertical orientation ensures uncompromised, robust measurements on tough samples with less cleaning, less downtime, and, with the longer lifetime expected from vertical torches, less replacement torches.

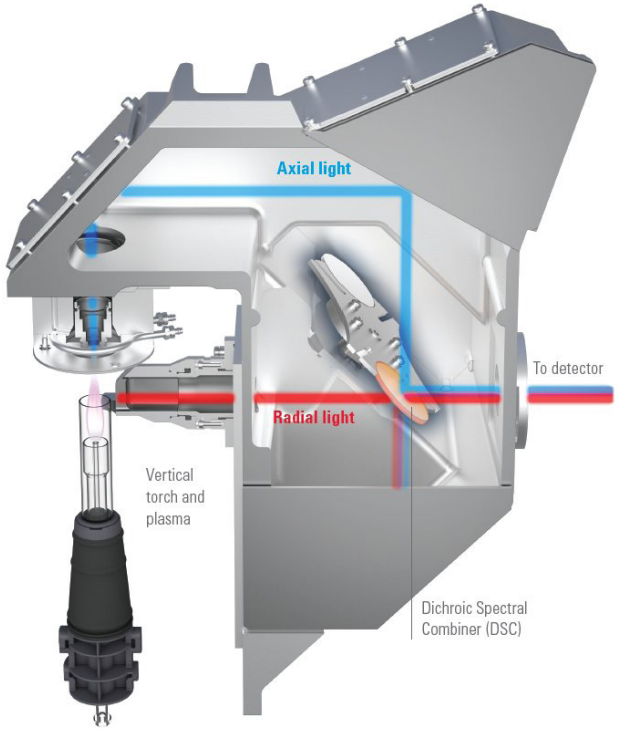

Figure 1. Schematic showing the emission from axial and radial plasma views synchronously converging onto the DSC with the combined emissions being transmitted into the polychromator optics.

Plug-and-play torch and solid state RF system

The 5110 ICP-OES features a plug-and-play torch, and a simple and effective torch loader mechanism that automatically aligns the torch and connects gases for fast start up and reproducible performance (Figure 2). Once loaded there is no need for further adjustments of the torch, or optical alignment of the axial viewing position. This automatic alignment is invaluable for labs where reproducible performance is required from operator to operator, and greatly reduces instrument to instrument variability. For ultimate stability, all plasma gas flows in the torch are controlled by mass flow controllers (MFC).

The 5110 ICP-OES features a solid state RF (SSRF) system that operates at 27 MHz and delivers a reliable, robust and maintenance-free plasma, designed for even the toughest samples. To run challenging samples, the RF system must be able to rapidly adjust to changes in the plasma conditions. The free running SSRF in the Agilent 5110 ICP-OES meets these challenges and can handle a wide range of samples, from volatile organics such as methanol, to brine samples with 30% NaCl. The RF system can operate at powers ranging from 700 W to 1500 W, unlike other dual view systems where the RF power has to be limited to 1350 W to avoid damaging the horizontal dual view torch.

Proof of performance

To demonstrate the excellent performance of the ICP-OES for the analysis of high TDS samples, a solution of 25% NaCl was spiked with 0.25 mg/L of a multi-element solution consisting of As, Cd, Pb, and Se. The sample was analyzed in SVDV mode, using a high solids dual view torch (2.4 mm ID injector), and the Argon Humidifier accessory. The solution was run as a sample for 4 hours with a rinse step included between each sample. The results are shown in Figure 3. The %RSD for all elements was found to be less than 2.1% over the 4 hour period.

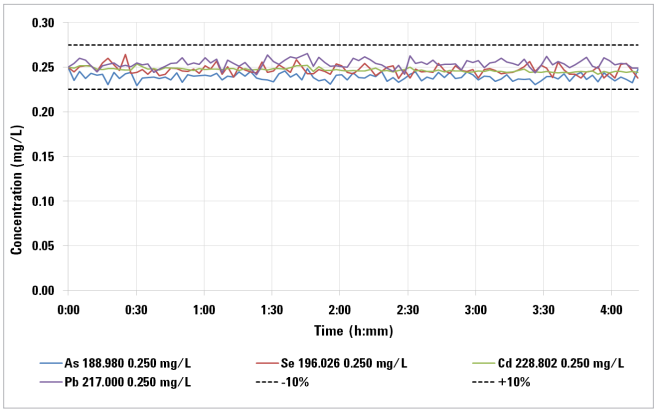

Figure 3. Stability test over 4 hours for a 0.25 mg/L multi-element spike in 25% NaCl.

Figure 2. Sequence of 3-easy steps to load the torch into the instrument for fast start up and reproducible performance.

Summary

Agilent's 5110 ICP-OES with a vertical torch provides the ultimate configuration for determining tough samples while achieving detection limits expected from an axially viewed plasma. The SSRF system delivers a reliable, robust and maintenance-free plasma for even the toughest samples and achieves unmatched long term stability. The plug-and-play torch with MFC control of all plasma gases eliminates the torch alignment process that is often required when analyzing challenging samples, and ensures consistent and reproducible results.

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