Atomic Emission Detector

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Introduction

As capillary column gas chromatography takes its place as the major, highest resolution separation technique available for volatile, thermally stable compounds, the requirements for the sensitive and selective **detection** of these compounds increases. Since more and more complex mixtures can be successfully separated, subsequent chromatograms (output of a chromatographic separation) are increasingly more complex. Therefore, the need to differentiate between the sample components *using the GC detector* as a means of compounds discriminating is more and more common. In addition, each detector has its own characteristics (selectivity, sensitivity, linear range, stability, cost, etc.) that helps in a decision about which detector to use.

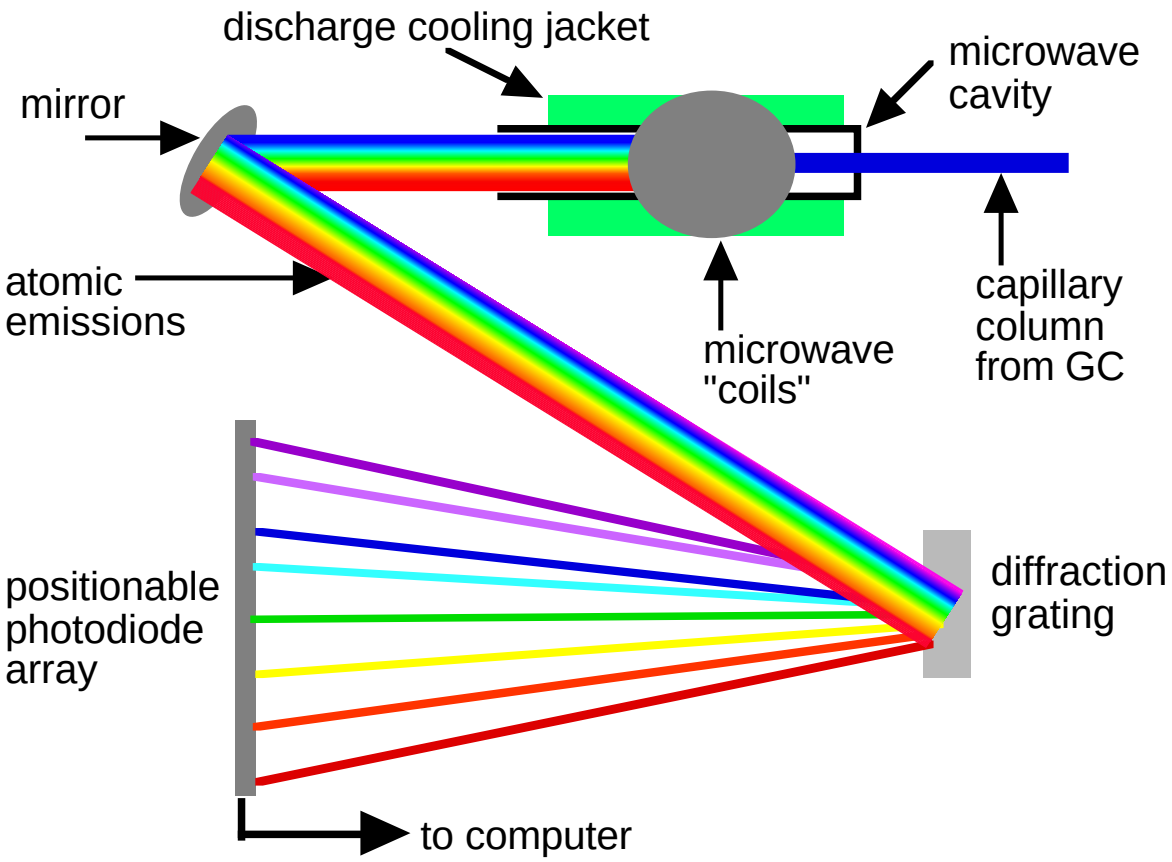
One of the newest additions to the gas chromatographer's arsenal is the atomic emission detector (AED). This detector, while quite expensive compared to other commercially available GC detectors, is an extremely powerful alternative. FOR INSTANCE, Instead of measuring simple gas phase (carbon containing) ions created in a flame as with the flame ionization detector, or the change in background current because of electronegative element capture of thermal electrons as with the electron capture detector, the AED has a much wider applicability because it is based on the detection of atomic emissions.

The strength of the AED lies in the detector's ability to simultaneously determine the atomic emissions of many of the elements in analytes that elute from a GC capillary column (called eluants or solutes in some books). As eluants come off the capillary column they are fed into a microwave powered plasma (or discharge) cavity where the compounds are destroyed and their atoms are excited by the energy of the plasma. The light that is emitted by the excited particles is separated into individual lines via a photodiode array. The associated computer then sorts out the individual emission lines and can produce chromatograms made up of peaks from eluants that contain only a specific element.

Instrumentation

The components of the AED include 1) an interface for the incoming capillary GC column to the microwave induced plasma chamber, 2) the microwave chamber itself, 3) a cooling system for that chamber, 4) a diffraction grating and associated optics to focus then disperse the spectral atomic lines, and 5) a position adjustable photodiode array interfaced to a computer. The microwave cavity cooling is required because much of the energy focused into the cavity is converted to heat.

Schematic of a gas chromatographic atomic emission detector



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