

Flame Photometric GC Detector

Introduction

The reason to use more than one kind of detector for gas chromatography is to achieve selective and/or highly sensitive detection of specific compounds encountered in particular chromatographic analyses. The determination of sulfur or phosphorus containing compounds is the job of the flame photometric detector (FPD). This device uses the chemiluminescent reactions of these compounds in a hydrogen/air flame as a source of analytical information that is relatively specific for substances containing these two kinds of atoms. The emitting species for sulfur compounds is excited S_2 . The λ_{\max} for emission of excited S_2 is approximately 394 nm. The emitter for phosphorus compounds in the flame is excited HPO (λ_{\max} = doublet 510-526 nm). In order to selectively detect one or the other family of compounds as it elutes from the GC column, an interference filter is used between the flame and the photomultiplier tube (PMT) to isolate the appropriate emission band. The drawback here being that the filter must be exchanged between chromatographic runs if the other family of compounds is to be detected.

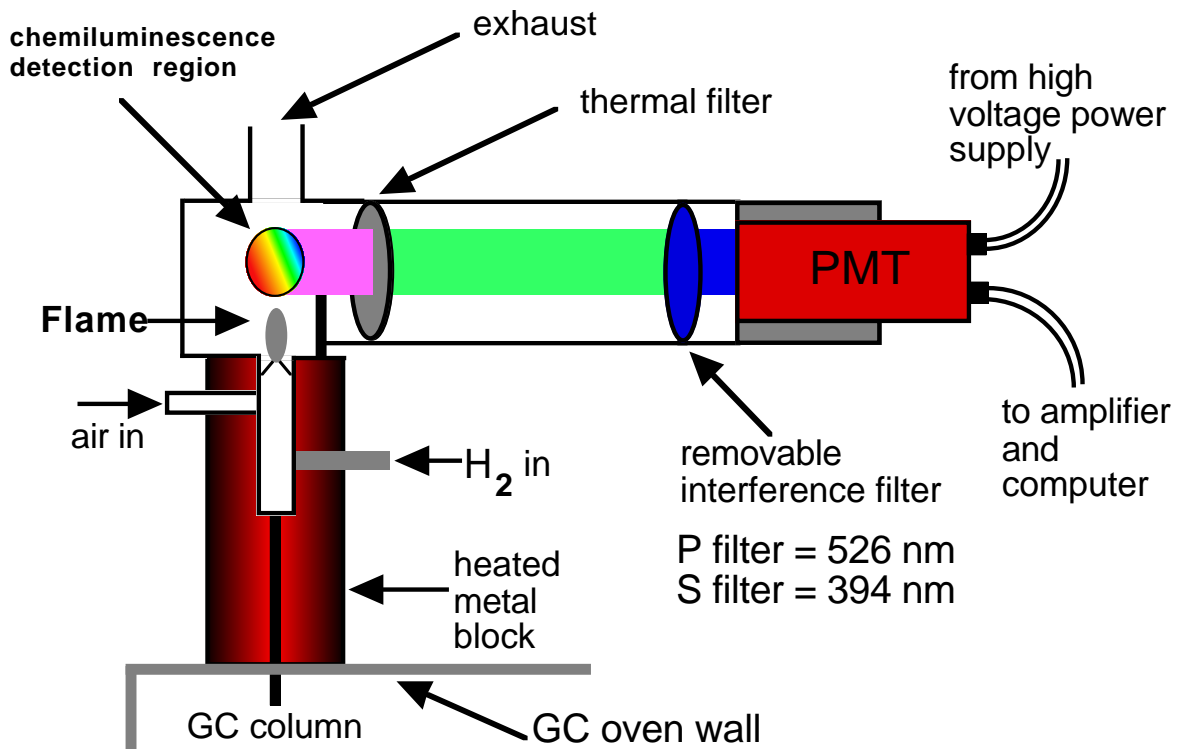
Instrumentation

In addition to the instrumental requirements for 1) a combustion chamber to house the flame, 2) gas lines for hydrogen (fuel) and air (oxidant), and 3) an exhaust chimney to remove combustion products, the final component necessary for this instrument is a thermal (bandpass) filter to isolate only the visible and UV radiation emitted by the flame. Without this the large amounts of infrared radiation emitted by the flame's combustion reactions would heat up the PMT and increase its background signal. The PMT is also physically insulated from the combustion chamber by using poorly (thermally) conducting metals to attach the PMT housing, filters, etc.

The physical arrangement of these components is as follows: flame (combustion) chamber with exhaust, permanent thermal filter (two IR filters in some commercial designs), a removable phosphorus or sulfur selective filter, and finally the PMT.

The next page of this document has a color schematic of the flame ionization detector.

Schematic of a gas chromatographic flame photometric detector



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