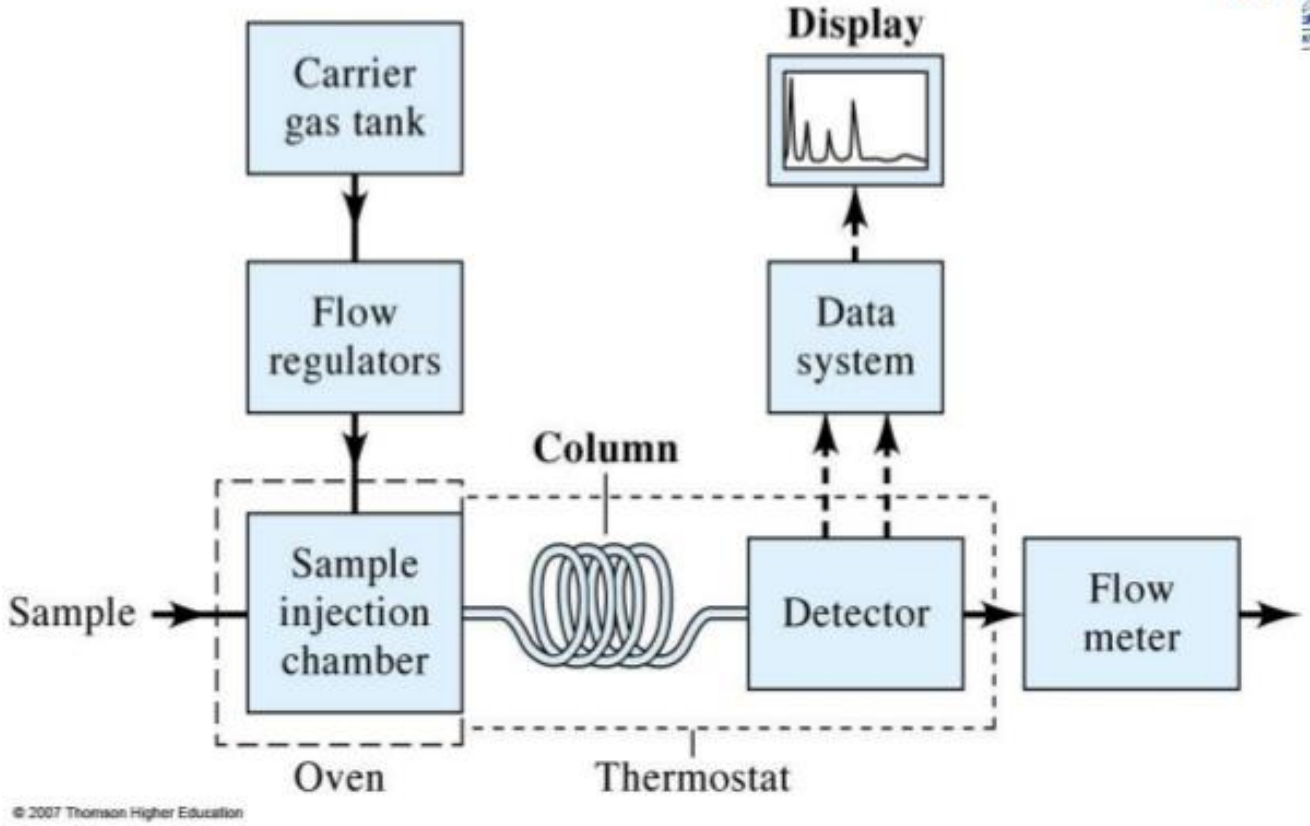
Chemistry 3403 Exp: GC-FID

Goals:

1. **Familiarization with GC-FID.**
2. **Column efficiency. Affect of temperature on efficiency.**
3. **Van Deemter plot. Plot of H vs. Linear flow.**
4. **Kovats retention index.**

GC-FID Schematic



Schematic diagram of gas chromatography

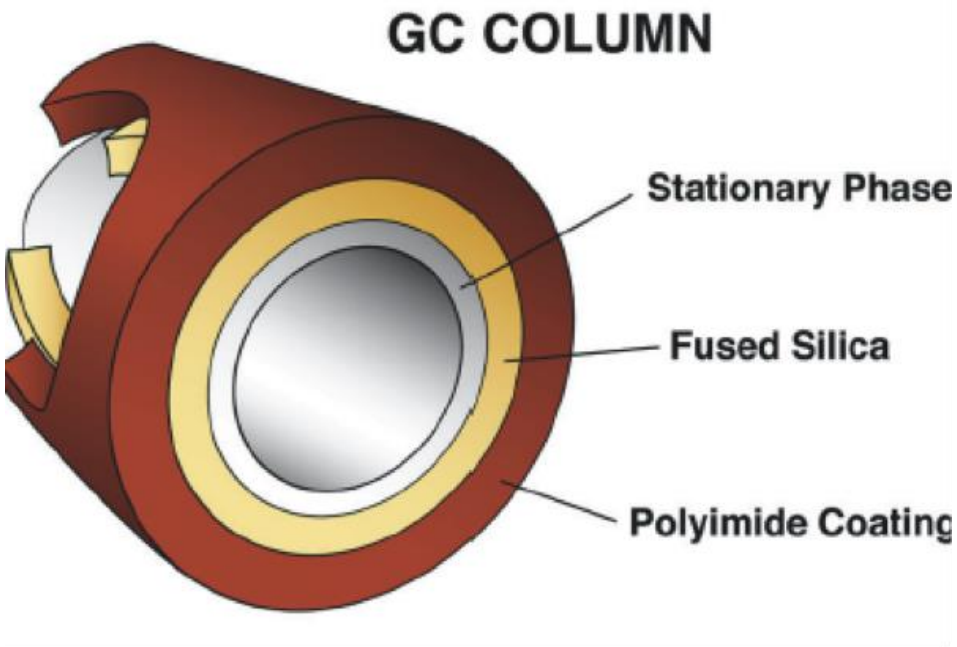
Reference: http://image.slidesharecdn.com/gc-mpharmsud-130408055024-phpapp02/95/gc-mpharm-sud-9-638.jpg?cb=1365400329

GC-FID Chromatography

Mobile phase: Carrier gas. Ex: He.

Stationary phase: Nonvolatile liquid bonded to a glass capillary column. Nonpolar.

GC Column

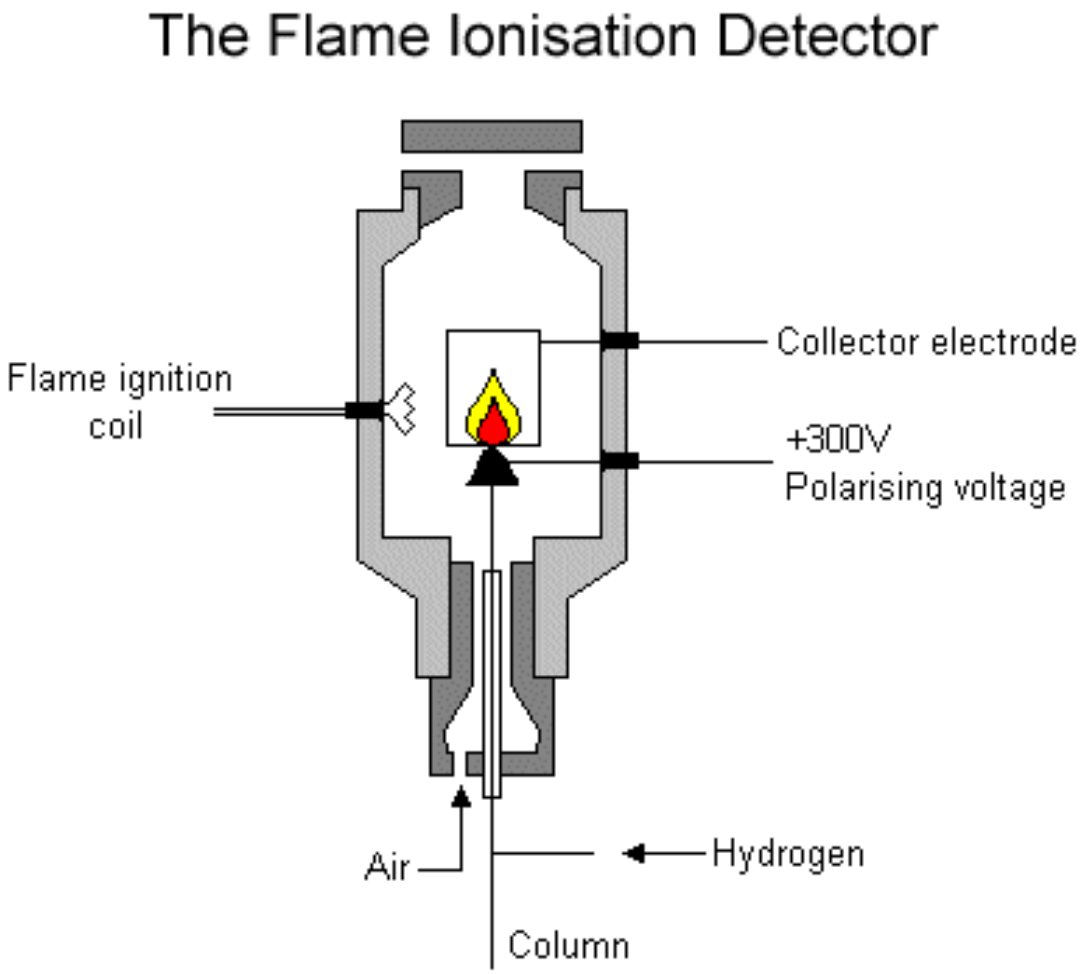


Column degrades at elevated temperatures and in presence of oxygen.

Reference: http://www.dot-red.com/wp-content/uploads/2009/09/dot-red-gc-column.jpg

http://www.thetruthaboutforensicscience.com/wp-content/uploads/2013/09/GC-column-inside.png

FID Detector:



Column Efficiency:

Plate Height(H) and Number of theoretical plates(N).

$$N = 16\left(\frac{t_r}{W}\right)^2 \qquad N = 5.54\left(\frac{t_r}{W_{1/2}}\right)^2$$

Where

t_r: retention time.

W: Peak width.

$W_{1/2}$: Peak width at half-height.

Van Deemter Equation:

Relates column efficiency to linear flow rate(μ).

$$H = A + \frac{B}{\mu} + C \cdot \mu$$

A: Multiple paths.

$\frac{B}{\mu}$**: Longitudinal Diffusion.**

C·μ: Mass transfer.

$$\mu \text{ (cm/hr)} = \frac{\text{Volume flow}(\text{cm}^3/\text{min}) \times \frac{60 \text{ min}}{\text{hr}}}{\pi r^2}$$

Kovats Retention Index:

Allows users to convert retention times(t_r) which are instrument dependent and convert them to a universal system of elution order.

Done by comparing retention times of a compound to those of known n-alkanes.

Kovats Retention Index cont:

$$I = 100[n + (N-n)\cdot\frac{Logt'_r(unk) - Logt'_r(n)}{Logt'_r(N) - Logt'_r(n)}$$

n: # of carbons in smaller n-alkane.

N: # of carbons in larger n-alkane.

$t'_r = t_r - t_m$