3.2 Tecnologia de Vácuo

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Ciência e Tecnologia de Filmes Finos
POSMAT – Unesp/Bauru

- (a) Medidores de pressão
- (b) Analisadores de gases
- (c) Regimes de escoamento

- 3.3 (a) Medidores de Fluxo
- 3.3 (b) Vazão e veloc. de bombeamento
- 3.3 (c)Exercícios – Cap. 3

- 3.2 (a) Medidores de pressão

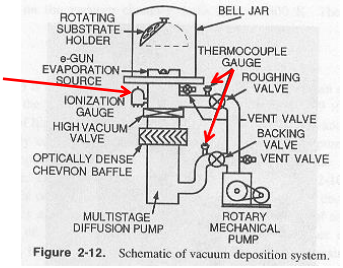
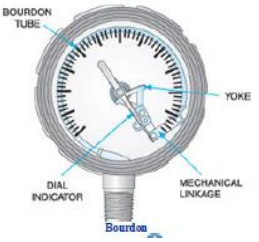
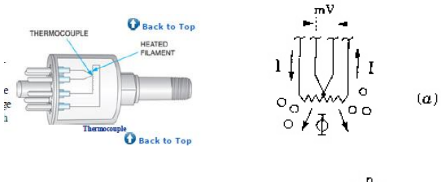


Figure 2-12. Schematic of vacuum deposition system.

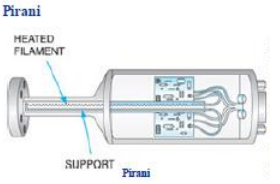


KJL Tecninical notes (língua de sogra)

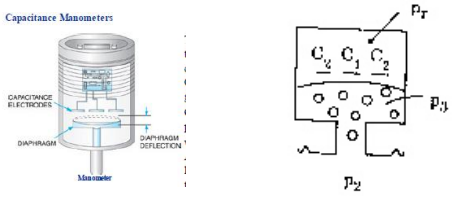
termopar



p_{ATM}- 10^{-2}torr

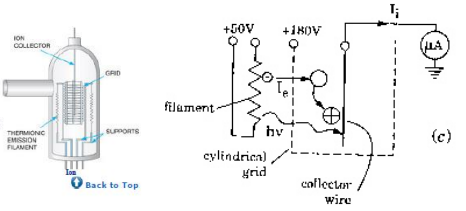


capacitância



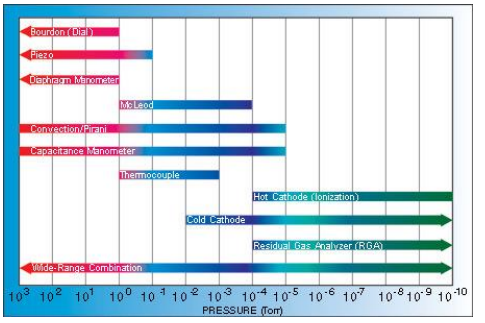
1 - 10^{-4}torr

Iônico / Hot filament



10^{-3} – 10^{-11}torr

Range – medidores de pressão



Medidores de Pressão

Conclusão:

* os medidores de pressão (vácuo) têm suas escalas típicas.

- Medidores de pressão
- 3.2 (b) Analisadores de gases
- Regimes de escoamento
- Medidores de Fluxo
- Exercícios – Cap. 3

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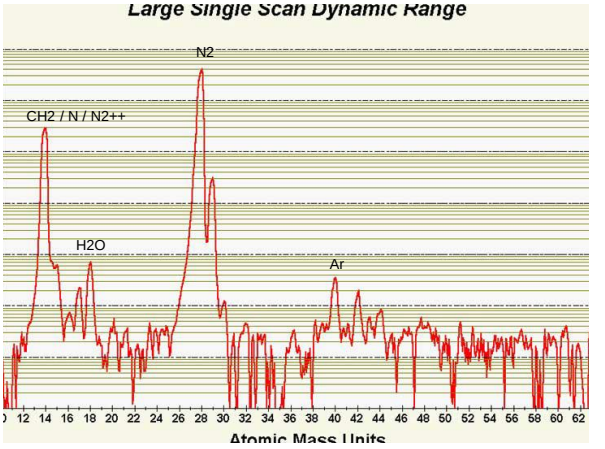
Analisador de gases residuais

- 100, 200 and 300 amu systems
- Better than 1 amu resolution
- 6 decades of dynamic range
- 5×10^{-14} Torr detection limit
- RGA Windows & LabVIEW software
- Field-replaceable electron multiplier and filament
- RS-232 interface

p_{res} ~ 10^{-2}-10^{-12} torr

Analisador de gases residuais



Analisadores

Regimes de escoamento

- Medidores de pressão
- Analisadores de gases
- 3.2 (c) Regimes de escoamento
- Medidores de Fluxo
- Exercícios – Cap. 3

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Regimes de Escoamento

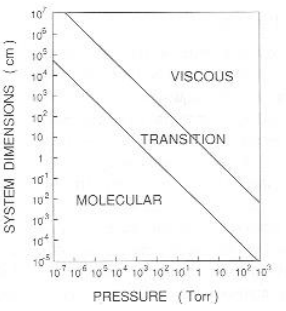
$$K_n = l/L$$

l = livre caminho médio

L=tamanho do sistema

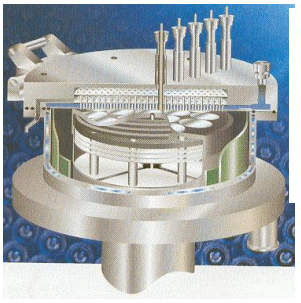
Número de Knudsen:

- **Kn > 1 – alto vácuo, colisões molécula-paredes (molecular)**
- **Kn << 0,01 – fluxo de fluido, colisões molécula-molécula (fluido / viscoso)**
- **0.01<< Kn < 1 – regime intermediário**



Regimes de fluxo de gás dominantes em função das dimensões do sistema e pressão

Reator CVD complexo (comercial)



Fluxo de gás / Inomogeneidades

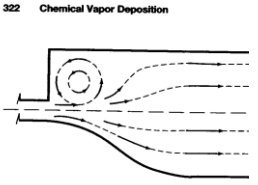


Figure 7.7 Two alternative reactor-entrance geometrie patterns (upper and lower halves). The upper patte avoided.

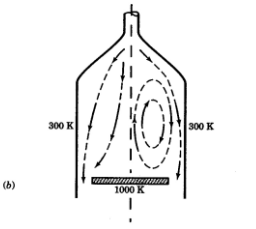


Figure 7.12 Typical free-convection roll cells: (*a*) horizontal rectangular-tube reactor (view along axis) with two alternate sidewall conditions, insulated (left) and cooled (right); (*b*) downflow axisymmetric reactor, showing two alternate flow patterns. In (*b*), the recirculating pattern (right) is to be avoided.

Distribuição de velocidades nas proximidades do susceptor (porta substratos).

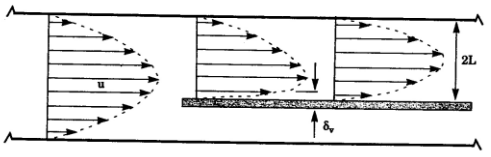


Figure 7.8 Velocity boundary layer of width δ_v forms at the susceptor leading edge in a tube reactor.

Linhas de fluxo de gás / simetria axial

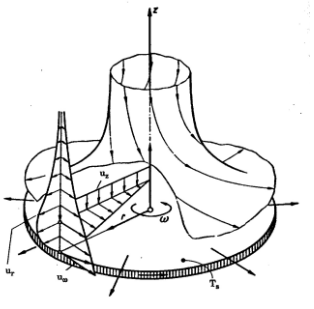


Figure 7.10 Axisymmetric flow pattern over a rotating disc. (Source: Reprinted from Ref. 7 by permission, © 1968 by McGraw-Hill Book Co.)

3.3 Tecnologia de Vácuo

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- 3.3 (a) Controladores de Fluxo
- Vazão e velocidade de bombeamento
- Exercícios – Cap. 3

Rotâmetro

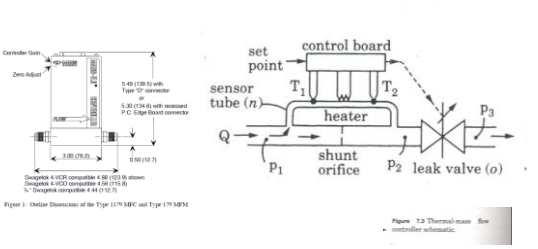
https://www.youtube.com/watch?v=BfdwD1V3jNk

(mesmo que o do eletrônico)

fluxo ~ 0.1 – 200 sccm

https://www.youtube.com/watch?v=BfdwD1V3jNk

(mesmo que o do rotâmetro)



fluxo ~ 0.1 – 200 sccm

- Medidores de pressão
- Analisadores de gases
- Regimes de escoamento
- Controladores de Fluxo
- 3.3(b) Vazão e veloc. de bombeamento
- => novo arquivo 3.3

=> Apresesentação 3.3