

# 2D critical temperatures in inverse gas chromatography

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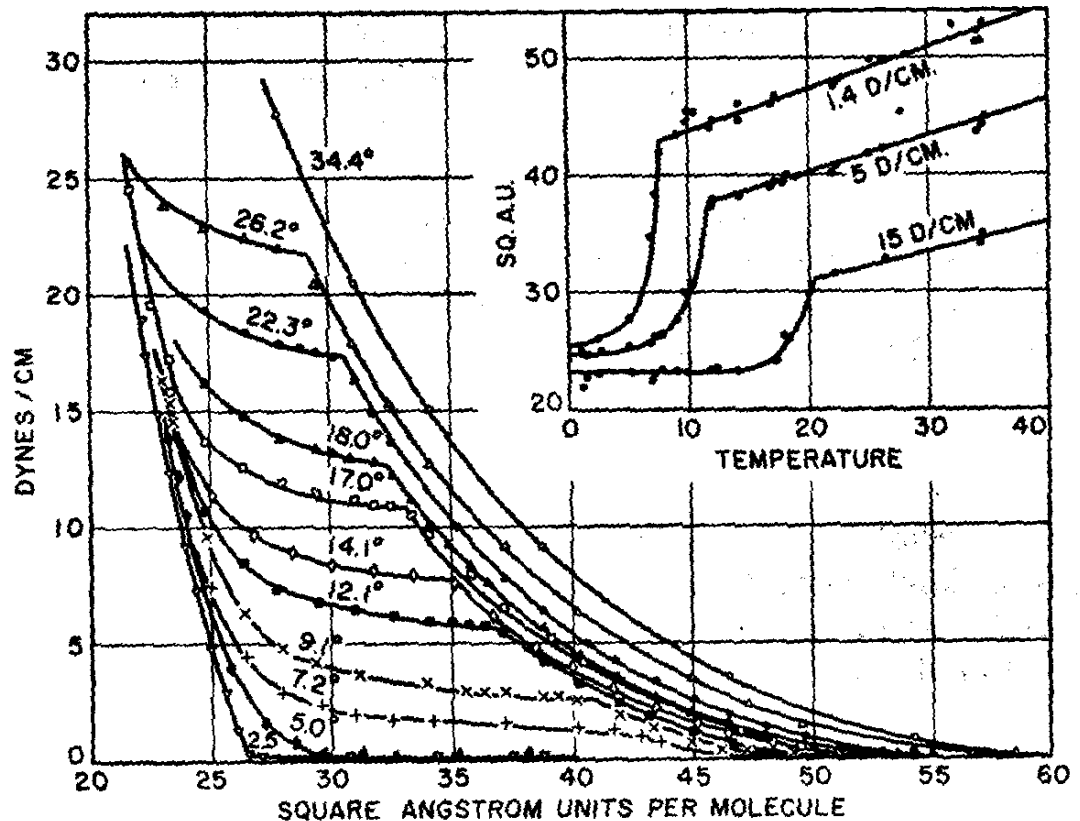
Ian Morrison, Cabot Corporation

# 2D phase transitions of spread monolayers

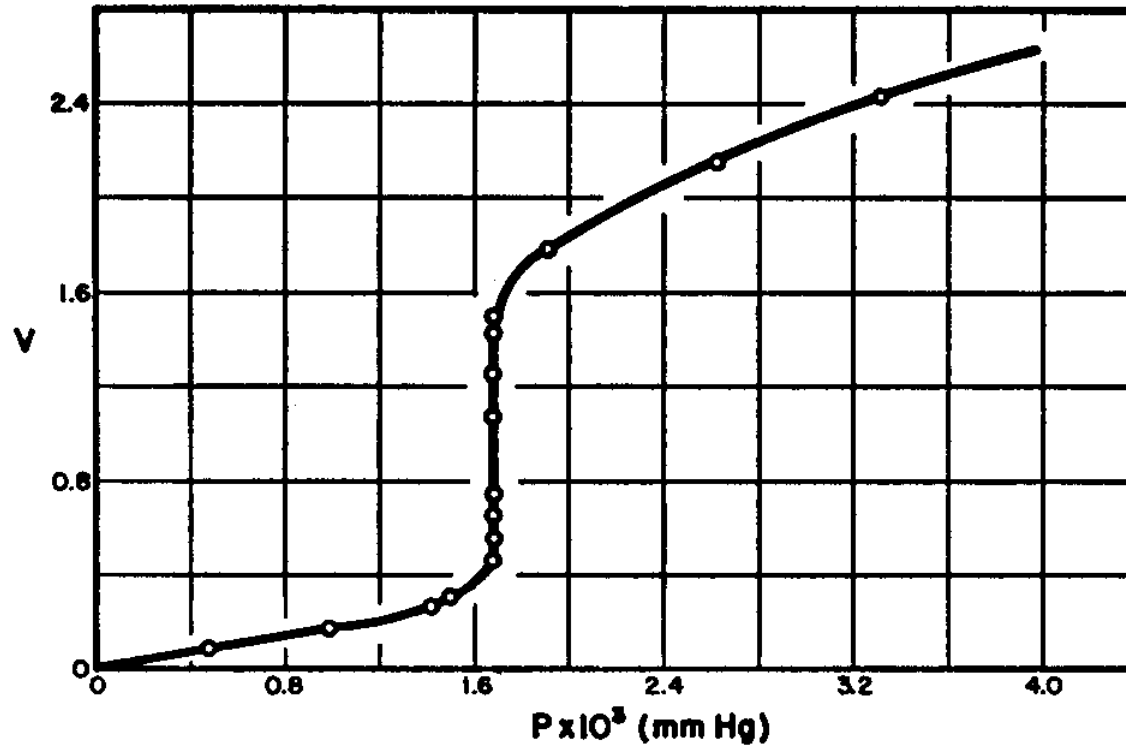
Tetradecanoic acid on  
0.01 N HCl at various  
temperatures.

(m.p. 55 C)

Adam and Jessop, *Proc. Roy.  
Soc.*, A112, 364 (1926)



# 2D phase transitions of adsorbed gas



Ross and Winkler, *J. Colloid Sci.*, 10, 330, 1955.

FIG. 2. Adsorption isotherm of krypton at 77.8°K. on graphitized carbon black, P-33, after correction of the values for thermal transpiration.

# Importance of phase transitions

- A “critical” test of understanding
- In gas adsorption
  - Is the adsorbed gas a separate phase?
  - What’s the change in entropy on adsorption?
- Scaling laws

# Inverse gas chromatography

- The packed column is the unknown.
- Multiple probes are used.
- Usually data is taken at infinite dilution.

Benzene on  
colloidal chrome  
oxide.

Onjia, et. al J.Serb. Chem.  
Soc., 67, 165, 2002

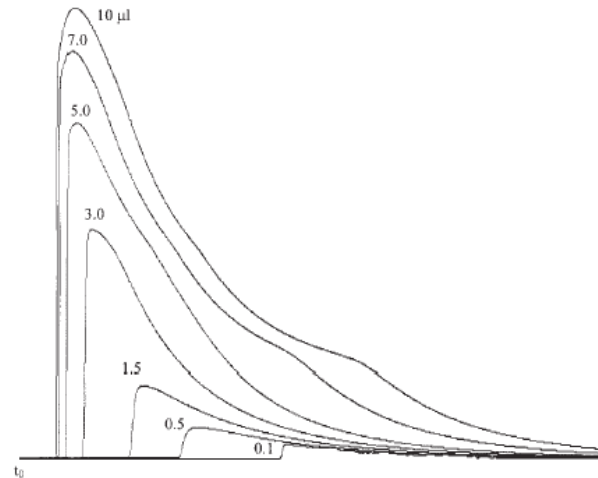


Fig. 1. Chromatographic peaks obtained for different amounts of benzene (0.1, 0.5, 1.5, 3.0, 5.0, 7.0, 10 µl) on solid II.  $T = 423$  K.

# Possible conditions

- Use a “uniform” surface - Carbograph
- Use an “inert” probe - hydrocarbon
- The 2D critical temperature is about half the 3D critical temperature.
- Keep the IGC  $>$  room temperature

Hydrocarbon	3D $T_c$ (K)	2D $T_c$ (C)
Hexane	507.68	-19
Heptane	540.68	-3
Octane	568.76	11
Nonane	594.56	24
Decane	617.6	36
Dodecane	658.3	56

# What is expected

- At high temperatures, that is above the 2D critical temperature, a usual IGC elution peak.
- Below a critical temperature, part of the IGC elution peak is flat, indicating desorption from a 2D condensed phase.

# IGC elution at various temperatures

