Trace Evidence: Glass

I. Glass Introduction

A. = a _____ type of trace evidence

B. _____ of glass

1. Common material in our _____
2. Found in many _____, sizes, _____, and types
3. Composed of fused _____ material
   - Mixture of:
     - _____
     - _____
     - _____
     - Other trace elements
4. Variation in _____ formulas can alter significantly its characteristic _____
5. Additives' responsibilities
   a. Alumina (_____)
      - Aluminum oxide
      - Improves chemical _____ and _____
   b. Boron Oxide (_____)
      - Addition used in borosilicate & aluminoborosilicate glasses.
      - Very _____ _____
   a. Lime (_____)
      - Added to improve _____ & chemical _____
   c. Lead oxide (_____)
      - High lead content lowers _____ = _____ hardness, but _____refractive index

II. _____ of Glass

a. Aluminosilicate & borosilicate
   - Can _____ _____ temps.

b. Laminated glass
   - Glass w_____ - used in car _____

c. _____ glass
   - Fine crystal

d. Soda lime glass
   - _____& _____ glass, glass containers, electric _____ _____, art objects

e. _____ (stressed) glass
   - Side & back windows of cars; breaks into _____

III. Glass as Evidence

A. Physical—_____

1. Can be used to _____people at a crime scene and _____ sequence of events
   - Does this make glass CLASS or INDIVIDUAL evidence???

- Can be used to reconstruct events
- _____
- Blood

- Glass is slightly _____
  - When it reaches its _____ _____ = _____
  - this leads to _____
  - 2 Distinct types of fractures
    1. _____
    2. _____

Key = _____ cracks will _____when they hit _____ cracks. This info can help determine _____ of events.

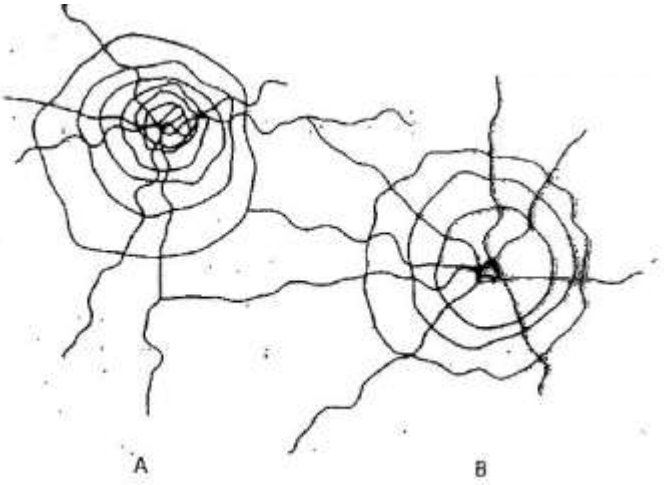


Figure 17-3: npact adial ..acture lines in glass end abruptly at fracture lines produced by a previous impact. In this case, Fracture B followed Fracture A.

- Direction of Impact
  - Found from _____marks on the _____ of broken glass.
    - At the _____ of _____, glass will break with a _____ pattern (shell-like)

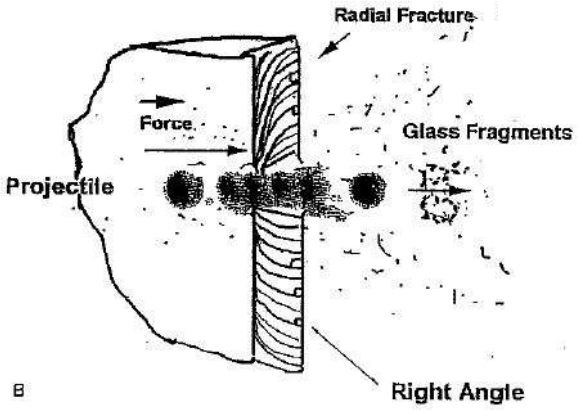


Figure 16.8B Coring effect fracture. The result of the impact of a high velocity projectile on glass. The fragmentation, coring, and fracture lines that confirm the direction from which the force originated can be seen.

B. Density determination =

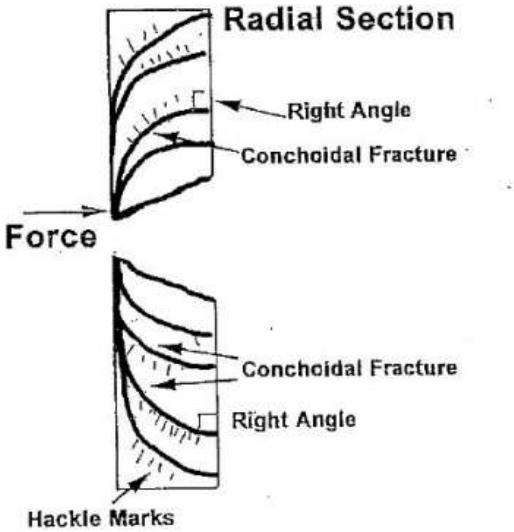


Figure 16.9 Expanded view of the conchoidal marks that appear on a fractured glass edge. The smaller hackle marks and the missing core area mentioned in Figure 14.8B are also shown.

C. Refractive index (____) determination

1. Background:
   a. **Refraction** = the _____ of a _____wave as it passes from one _____ to another
   b. **Refractive Index (RI)**= a _____ of the speed of _____ in a vacuum to the speed of light in _____substance
      - **Sample calculation**: speed of light in vacuum is 3.00×10^{10} and the speed of light in water is 2.25×10^{10}
      - Thus RI of water =

2. Determining the RI from samples in an investigation:
   a. Different types of _____will have _____ ____
   b. To analyze this property→
      Glass fragments can be _____ in a liquid with a _____refractive index to help _____ the RI of the _____

Liquid	Refractive index
Ethyl acetate	1.373
n-butyl alcohol	1.402
Olive oil	1.467
Corn oil	1.473
Castor oil	1.482
Methyl salicylate	1.522
Clove oil	1.543
Canola oil	1.465-1.467

i. Analysis method 1

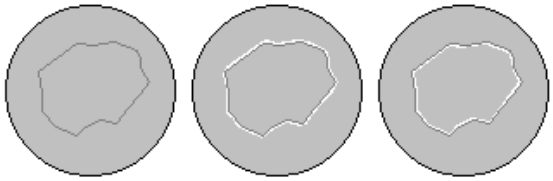
--If the liquid has the _____RI as the glass sample, the glass will _____ under a microscope.

--If the liquid has a _____ or _____RI, the glass is visible and a _____ appears around perimeter (we call this halo the _____).

. . . when RIs are the _____, the Becke line _____

. . . if Becke line appears on the _____perimeter = Glass has _____

. . . if Becke line appears on _____ perimeter = Glass has _____



ii. Analysis method 2

- RI is dependant on:
  - The _____of light
  - The _____of the medium
  - When the temp. of a liquid is changed, the RI changes rapidly, but the RI of an immersed solid will not
  - _____usually used
  - Oil _____so RI can be determined from its temp.
  - Sample glass is immersed in oil
  - Oil is _____ to determine match temp.
    - Glass _____
    - Oil RI = Glass RI

D. Chemical Tests

- _____
- Test for silicates, metal oxides, trace evidence