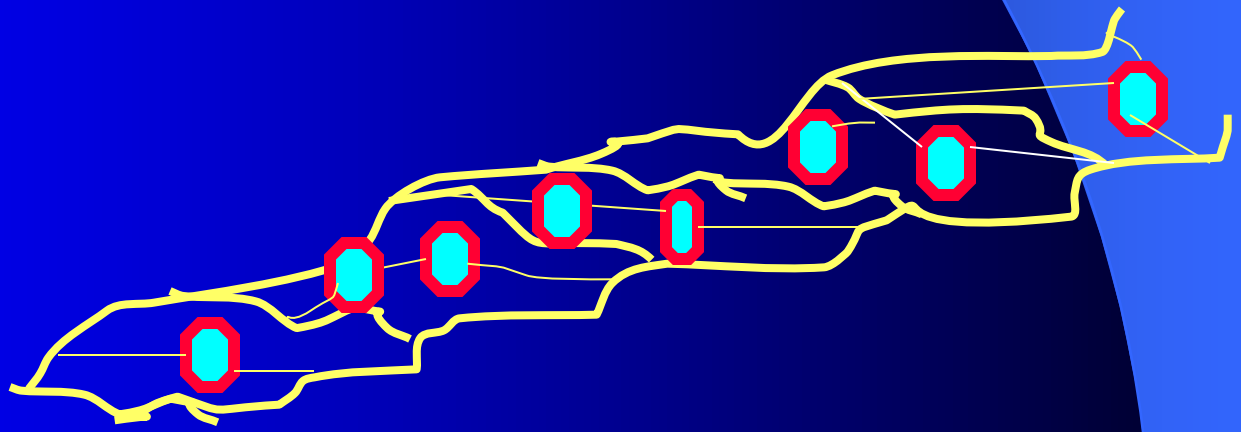
# Composite filling materials

**Chemically bonded mixture of organic matrix and inorganic filler**



# Composition

- **Organic matrix – resin**

Bowen monomer Bis GMA

(product of the reaction of Bisfenol A and Glycidyldimethacrylate)

UDMA (Urethandimetacrylate)

Oligomer – more flowable (thinning):

TEGMA (tetraethylendimetacrylate)

# Composition

- **Filler**

Milled quartz

Aluminium silicate glass

Silica

Prepolymer

Nanoparticles

Prepolymer

Agglomerates of the filler

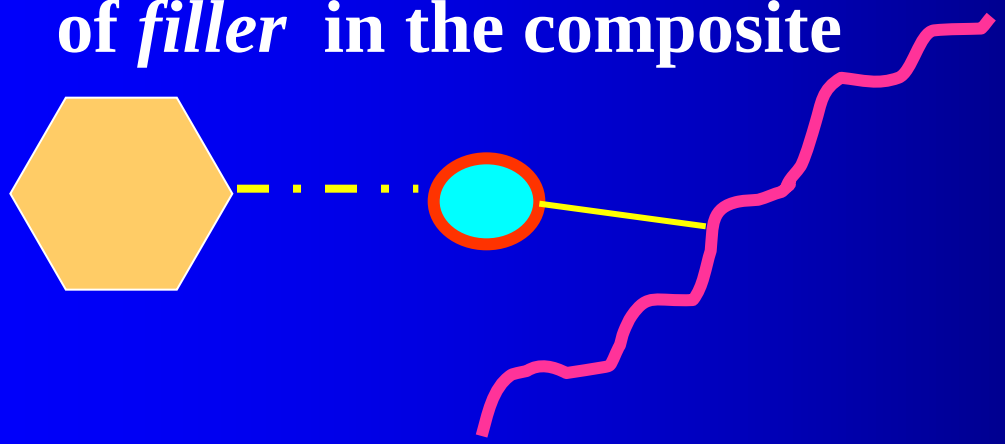
# Composition

- **Coupling agent**

**Silan**

**Binding between organic and inorganic part**

**It is responsible for the homogenous distribution of *filler* in the composite**



# Composition

Iniciators and accelerators

Other components

- Pigments
- UV absorbers

# Classification acc.to size of filler particles

Macrofiller composites (size micrometers)

Microfiller composites (size 0,02 -0,04 micrometers)

*Homogenous*

*Non homogenous*

Hybride composites (combination of varioue fillers)

# Modern hybrid composites

Microhybrid composites

Nanohybrid composites

Various sizes and material of the filler - excellent polishability, good mechanical properties (high abrasion resistance)

# Classification acc. type of filler

**Macrofiller**

**Microfiller**
(pyrogenic $SiO_2$)

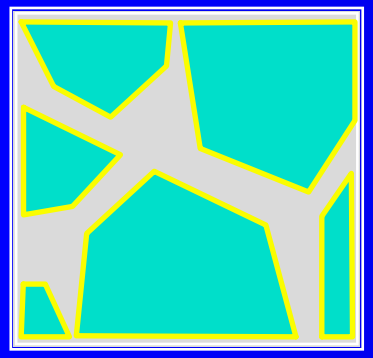
**Microfiller-complexes**

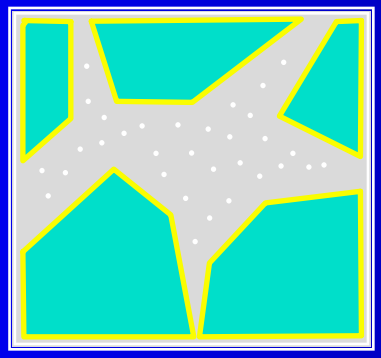
**Macrofiller Composite**

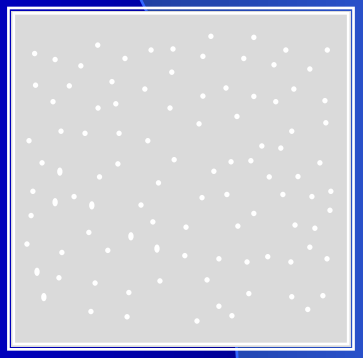
**Hybrid Composite**

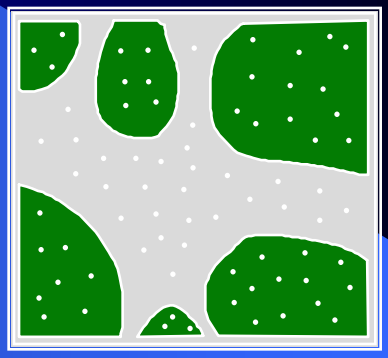
**homogenious Microfiller Composite**

**inhomogenious Microfiller-Composite**

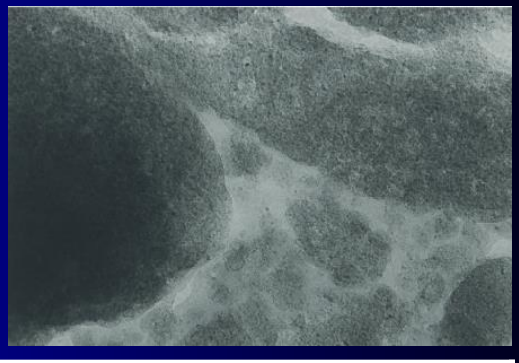






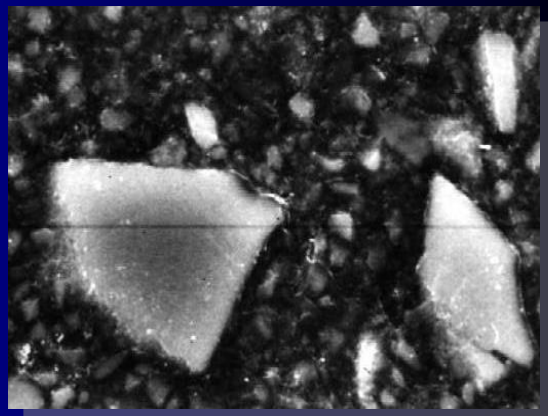


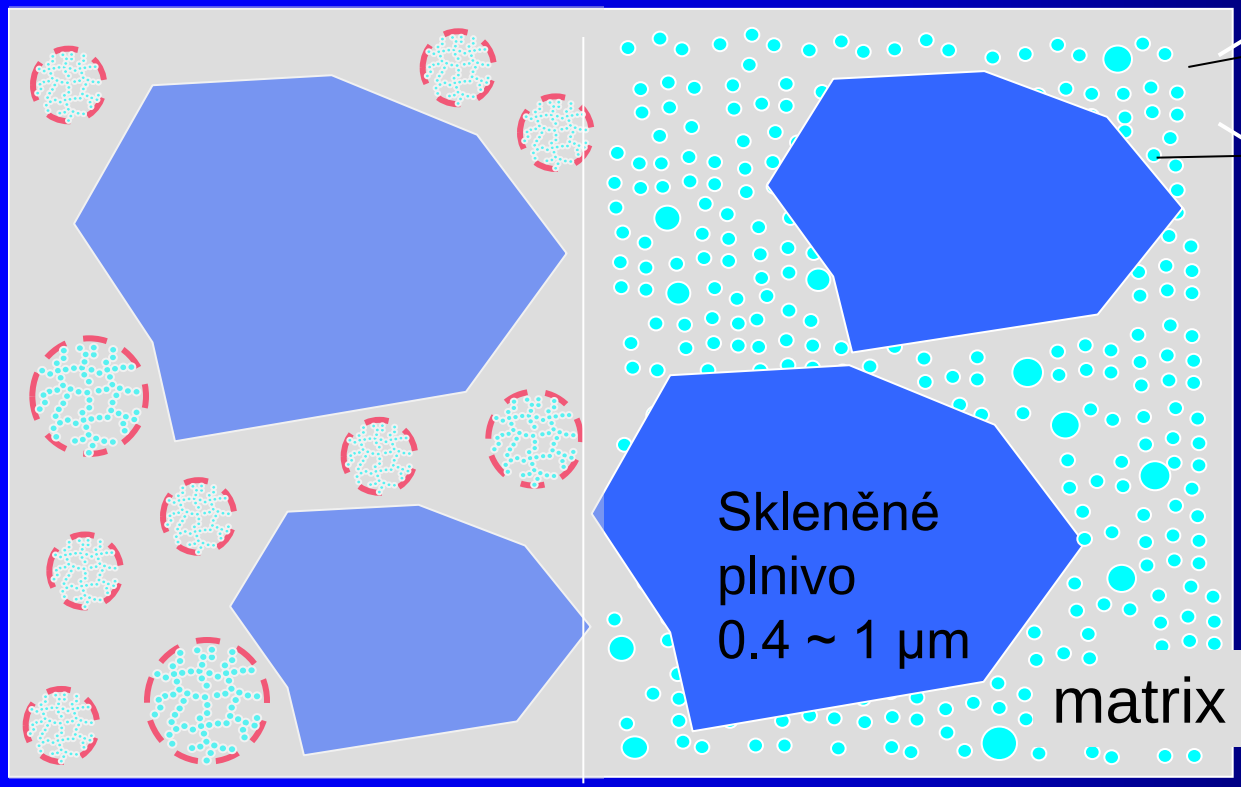
# Filler particles

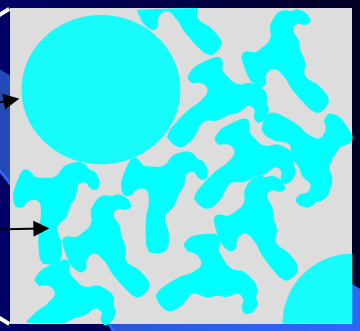


| Filler size (medium particle size) | Composite category |
|---|---|
| < 10 μm | hybrid composite |
| < 5 μm | fine particle hybrid |
| < 3 μm | ultrafine particle hybrid |
| < 1 μm | submicron hybrid , nano composites |

# Filler - example





More filler
→
Less amount of resin
→
Lower polymerization shrinkage

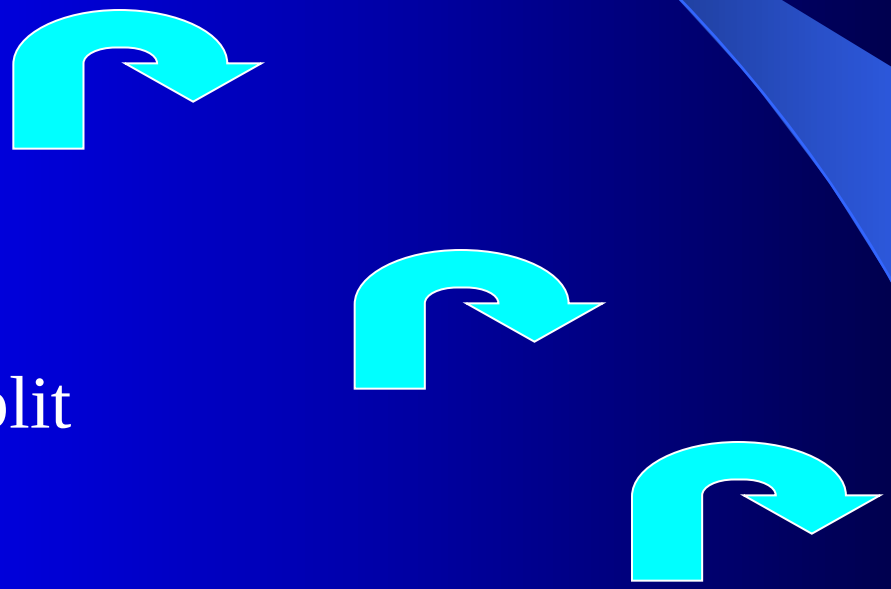
# Polymerization reaction

Accelerator

Iniciator

Double bonds – split

Polymer network



# Curing

- Light curing composite materials
- (Light activated).

Light activation is accomplished with the blue light (470 nm)

Initiator is camphorquinon, phenylpropandion,lucirin

- Selfcuring composite materials

Iniciator is organic peroxide, accelerator tertiary amine

# Classification acc to mode of curing

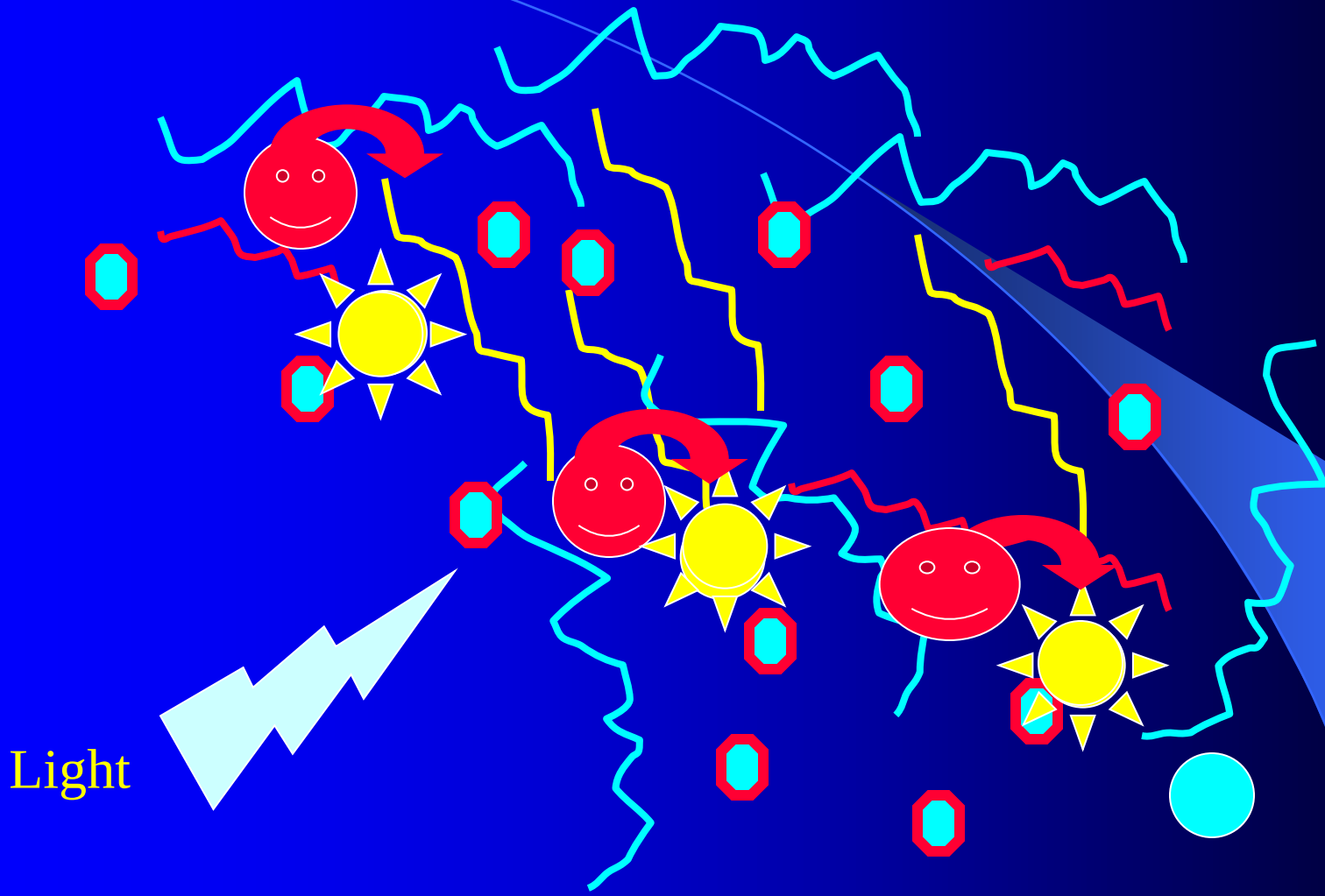
- Light curing
- Self curing (chemically curing)
- Dual curing (cementzs)
- Heat curing (for dental lab)

# Polymerization units

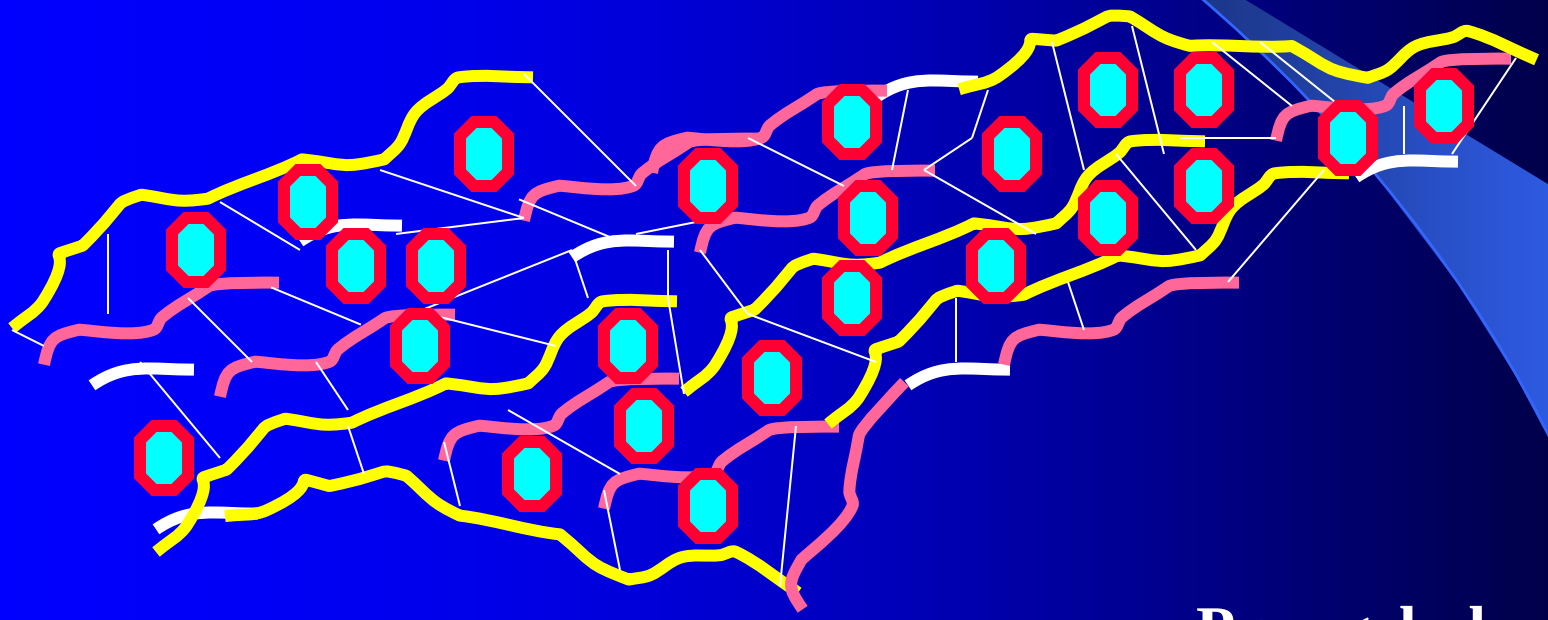
- Quartz halogen units
- LED units

Blue light, 400 – 500 nm.

Camphorchinon 470 nm (maximum absorption)


Light

# Polymer network



Polymerization shrinkage

**Pre –gel phase**
**Gel-point**
**Post –gel phase**

# Indications – fillings

Frontal area:

Class III., IV, V.

Posterior area

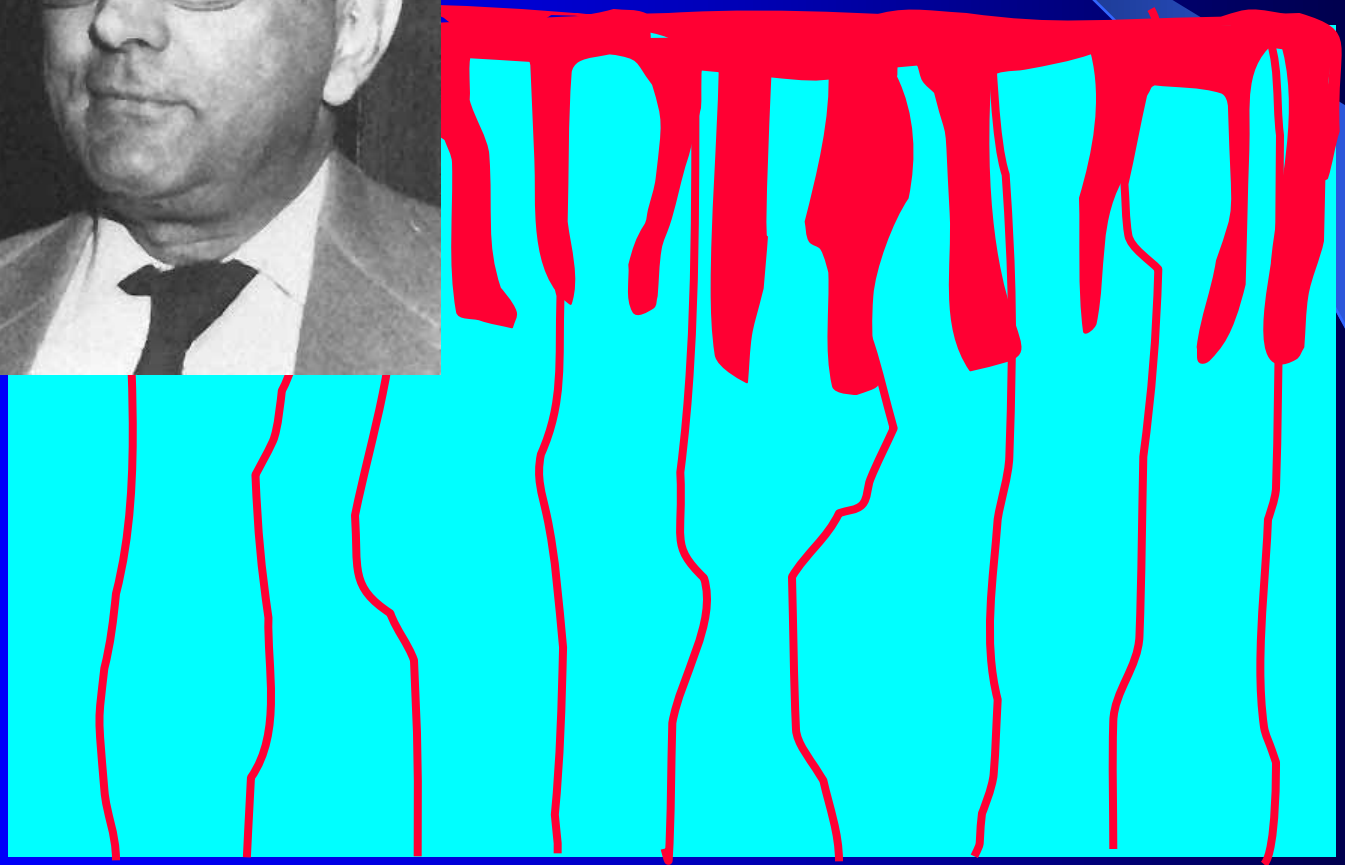
Small – moderate cavities I. and II. class

# Contraindications

- Bad level of oral hygiene
- Dry operating field is impossible
- Large cavities I. and II. class

# Principle of retention - micromechanical

Buoconore




35% - 37%  phosphoric acid
silica particles
blue dye

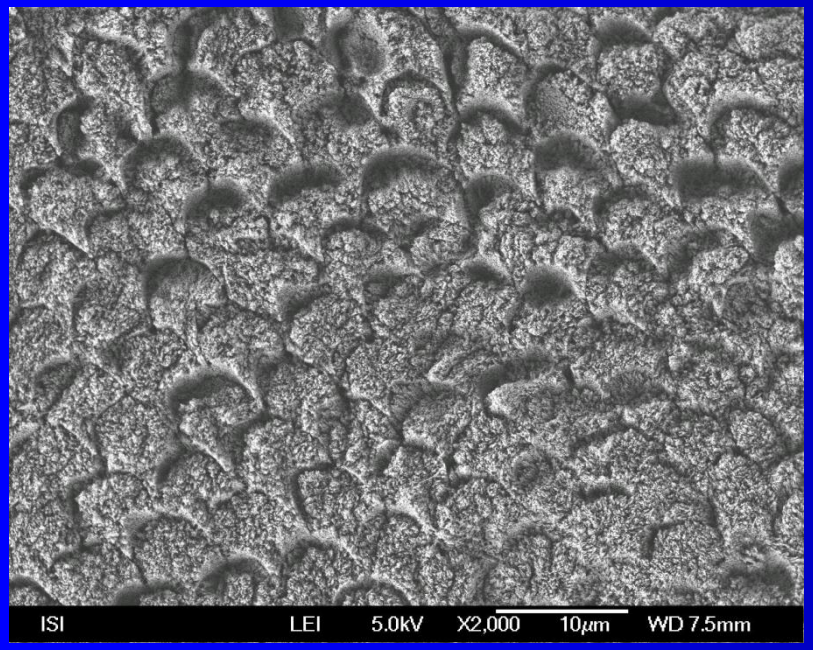
# Retention in enamel

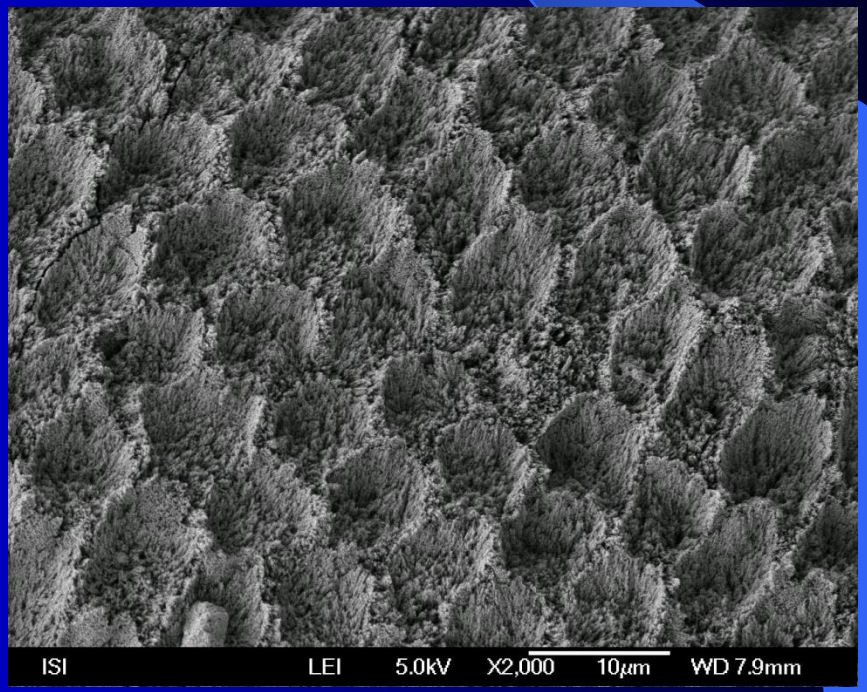
Acid etching of enamel

Irregular surface – retentive pattern

Speces between enamel rods or in enamel rods are created

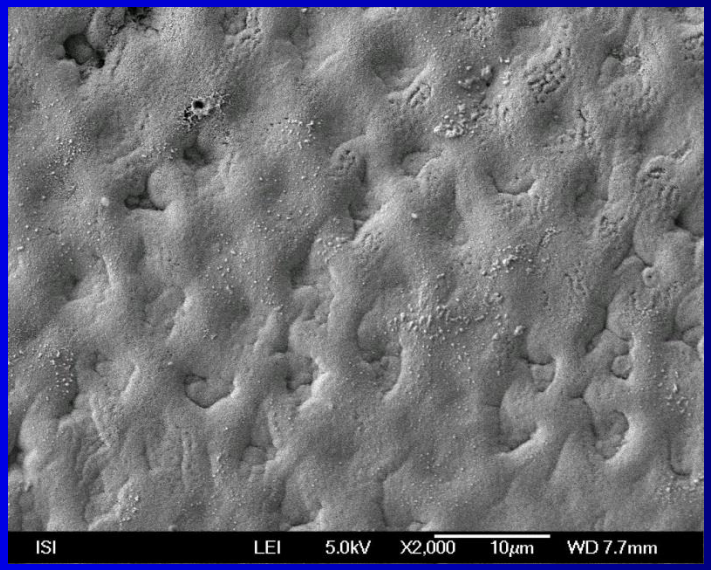
The material flows into these spaces



# Aprismatic enamel

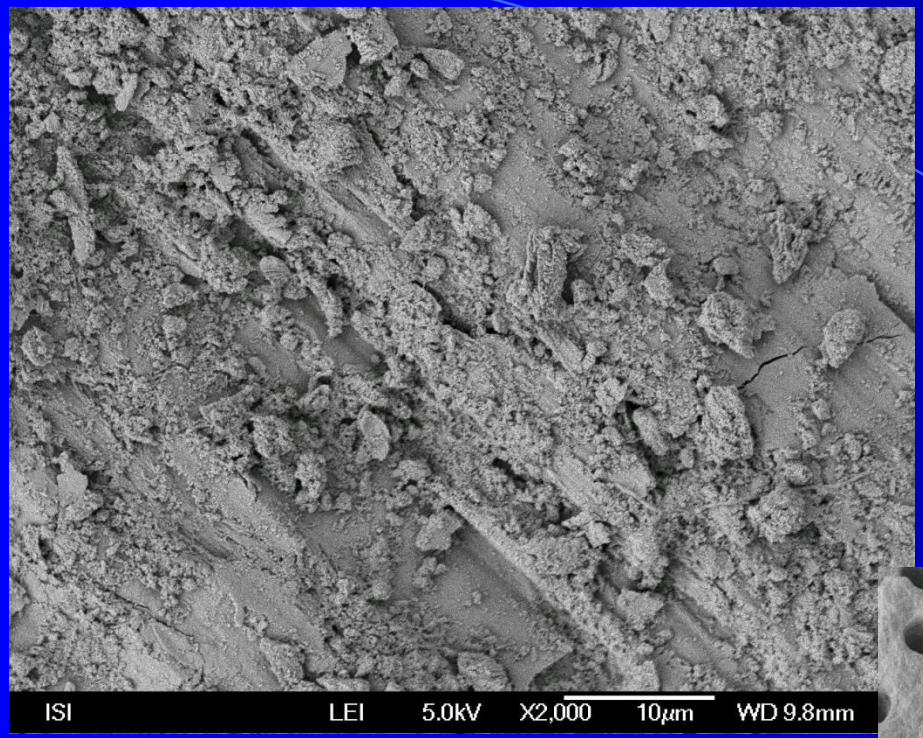
- On the surface of enamel there is aprismatic enamel. It is difficult to be etched in order to achieve the retentive pattern. It must be removed with diamond (red coded, fine)



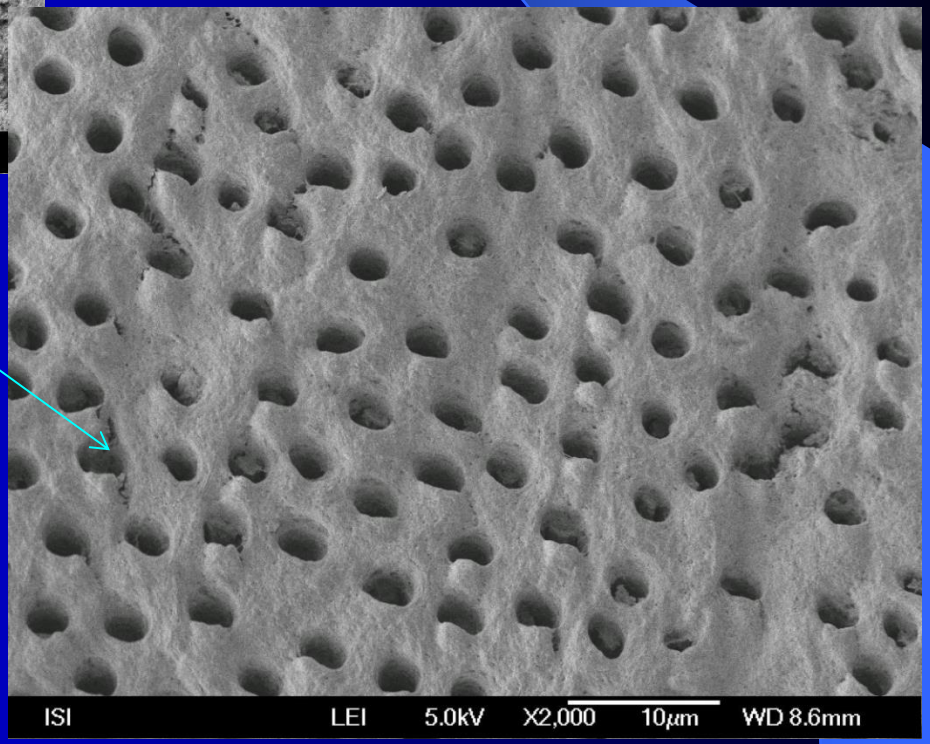
# Retention in dentin

*Dentin x enamel*

- More water and organic components
- Tubular liquor
- Smear layer (layer after preparation composed of collagen fibers, crystals of hydroxyapatite that have been destroyed during preparation and microbs)

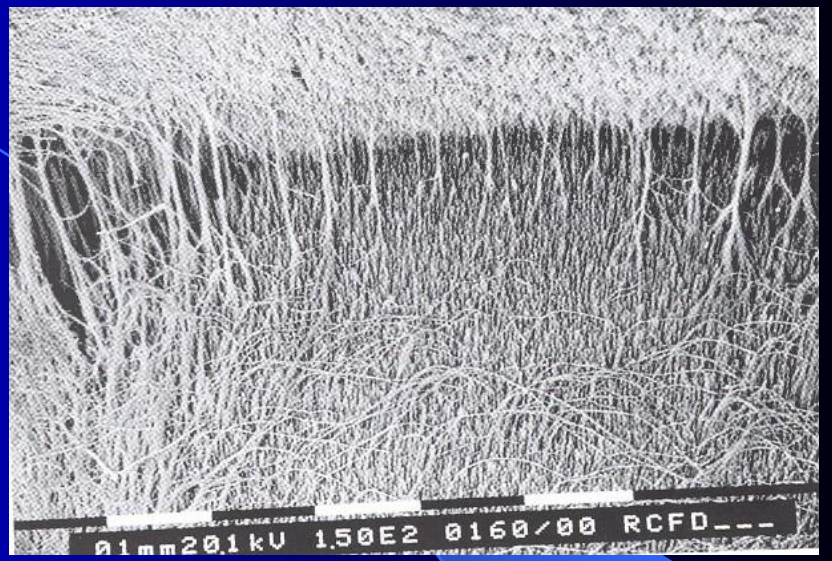



Smear layer

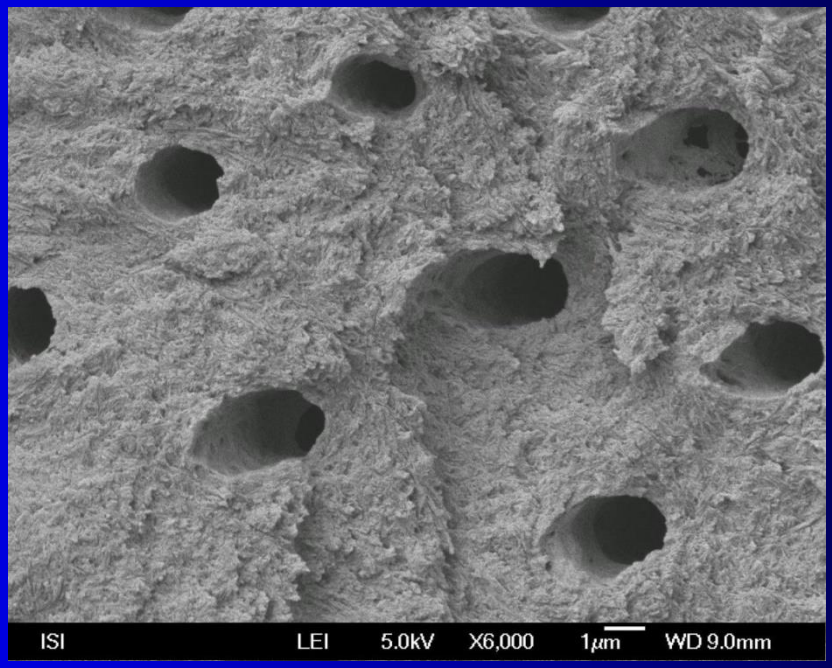



With acid etching
smear layer is
removed,
dentin tubuls are opened and
the surface of collagen
network decalcified

The material can flow into dentin tubules and penetrates into spaces in collagen network.
This is also micromechanical retention.




Bond itself is not able to penetrate into dentin tubules
Primer is necessary.



# Adhesive system

- We need adhesive systém for penetration into microscopic spaces after acid etching.

It consist of primer and bond

# Primer

Open the collagen network in dentin and keep it open: Withiout it the bond would not be able to penetrate inside.

# Bond

- **Flows into spaces in enamel after etching, into dentin tubules and to spaces in collagen network. Dentin must be pretreated with primer.**
- **Bond is an unfilled resin of the same composition as composite material**

# Making filling

- Preparation
- Enamel is beveled in most cases – retentive border
- Acid etching
- Washing
- Bonding
- Placement of filling material – in portions
- Curing with light
- Finishing and polishing (extra and ultrafine dimonds and rubber instruments)

# Glassionomers

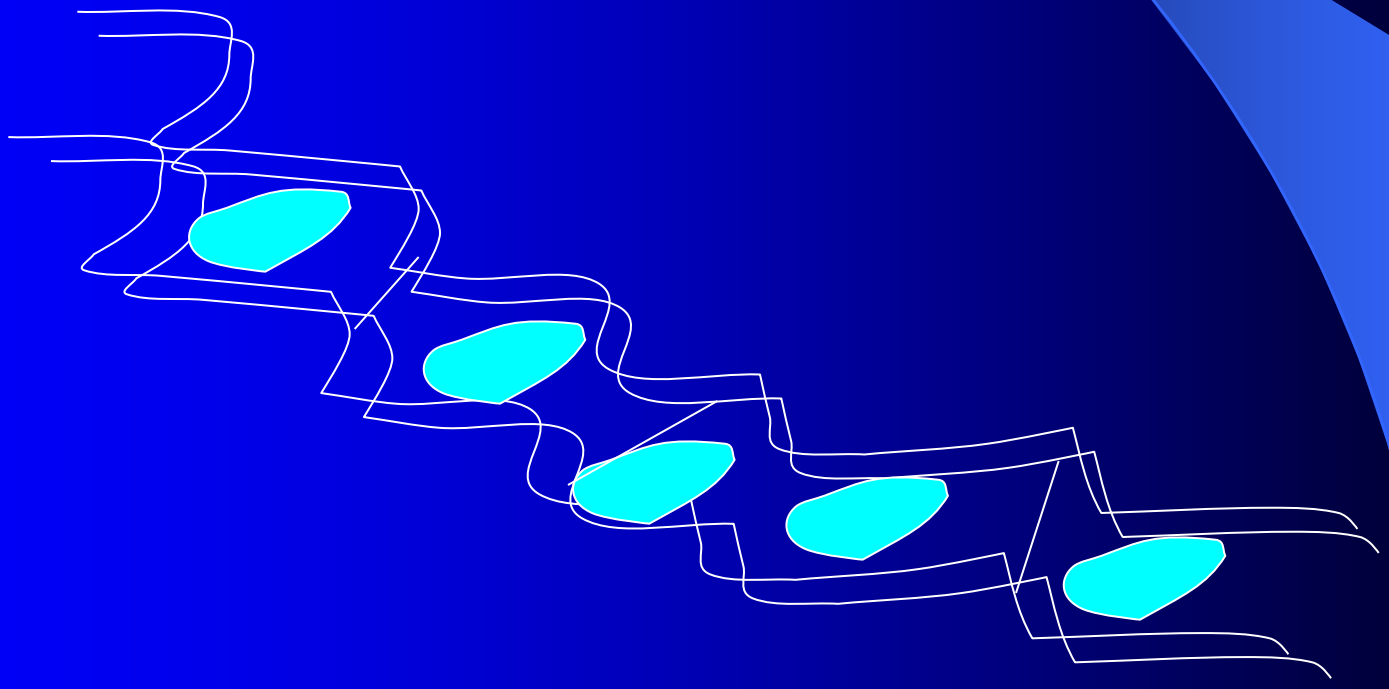
Composition

Powder: Aluminiumsilicate glass($SiO_2$, $Al_2O_5$, CaO, $N_2O$,$P_2O_5$, F)

Liquid: Polyacid
(polyacrylic, polymaleic)
Tartaric acid,
Water

# Glassionomers

- Principle of setting – acid base reaction



# Glassionomers

- Chemical bonding to hard dental tissues
- Thermal expansion similar to dentin
- Realease fluoride ions

Mechanical not strong enough

Aesthetics acceptable

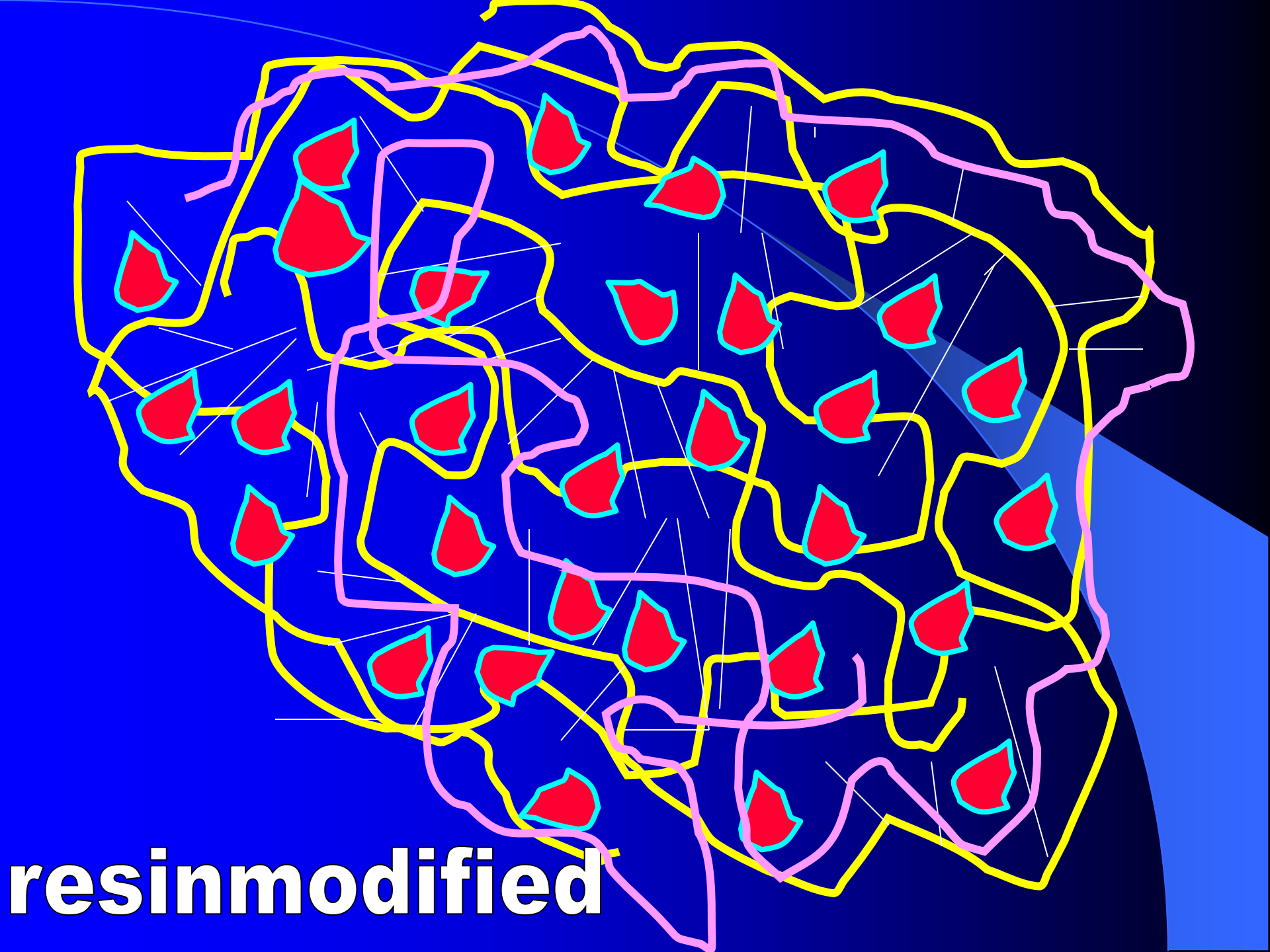
# Glassionomers acc to curing

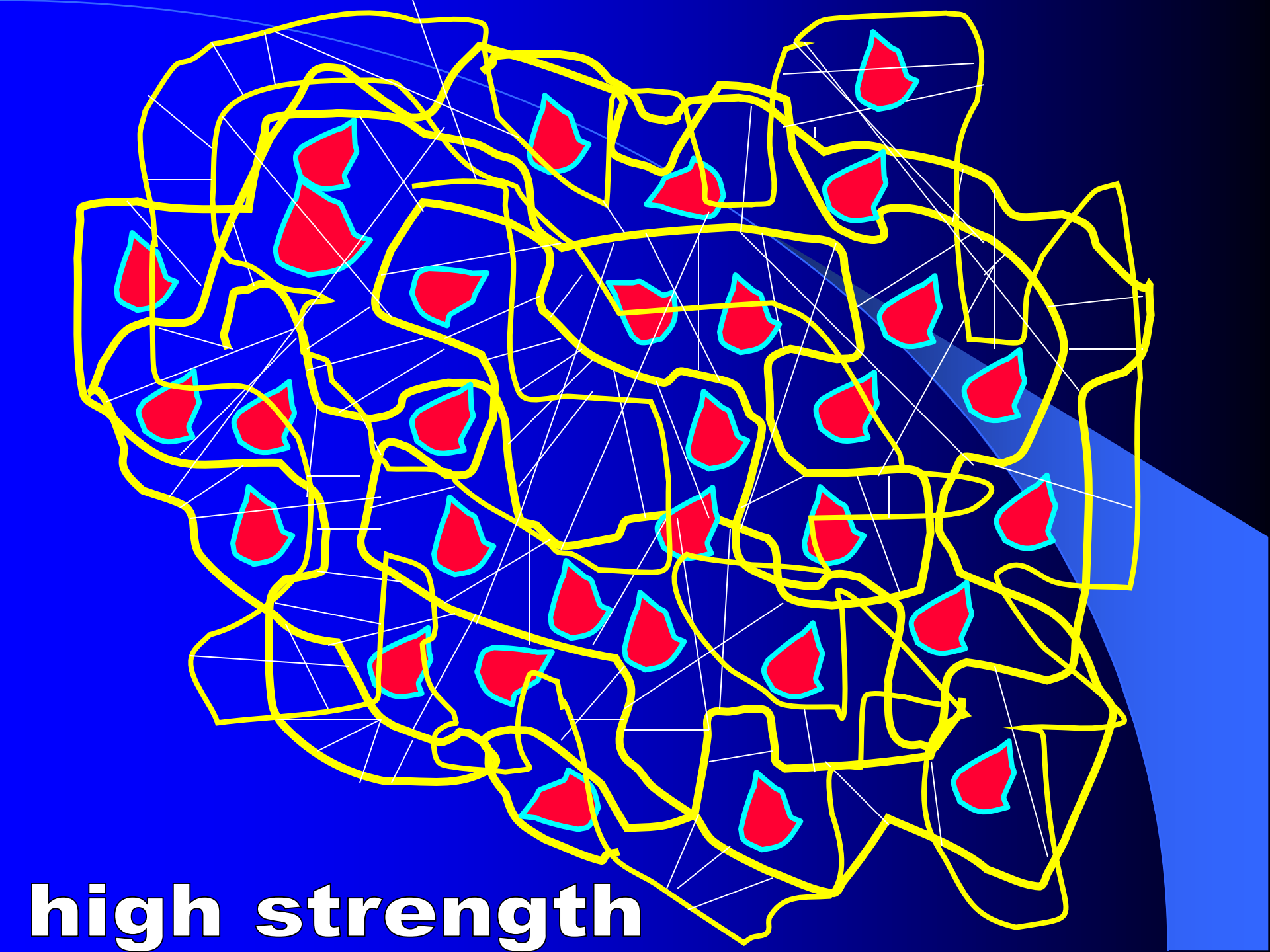
- Acid – base reaction

- Dual cured glassionomers (resin modified)

Acid base reaction + polymerization


dentin


resinmodified


high strength

# Glassionomers - indications

- Fillings

Class V., III.,
I., II. in primary dentition

Sealants

Protection of tooth surface

# Glassionomers - contraindications

- Fillings

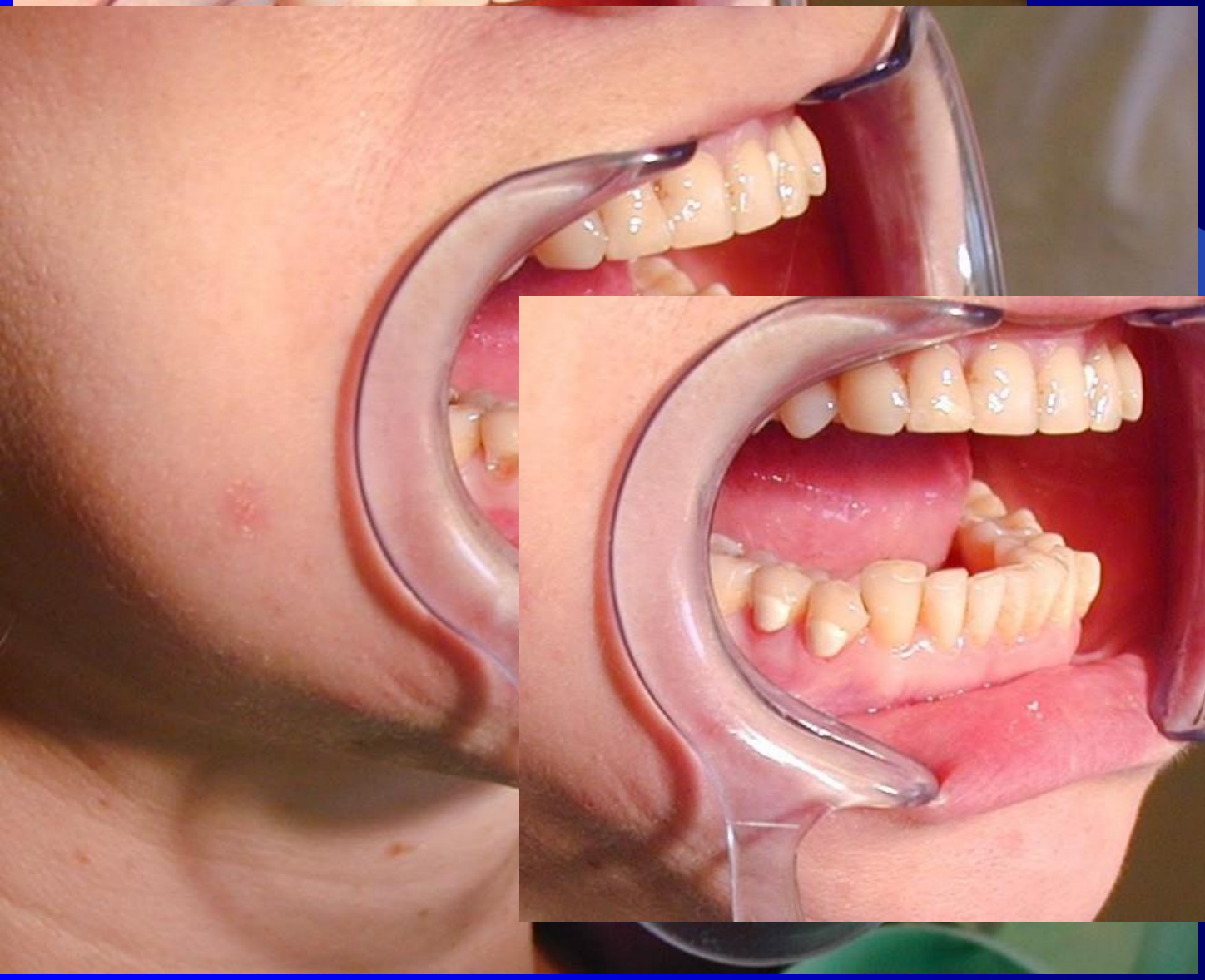
Class IV., I,. II. (except of primary teeth)

# Mixing

Hand

Power driven - capsulated





# Making filling

- Preparation
- Smoth bordes
- Limited on caries lesion only
- Conditioning
- Washing
- Filling in one block
- Varnish after setting
- Polishing in next appointment