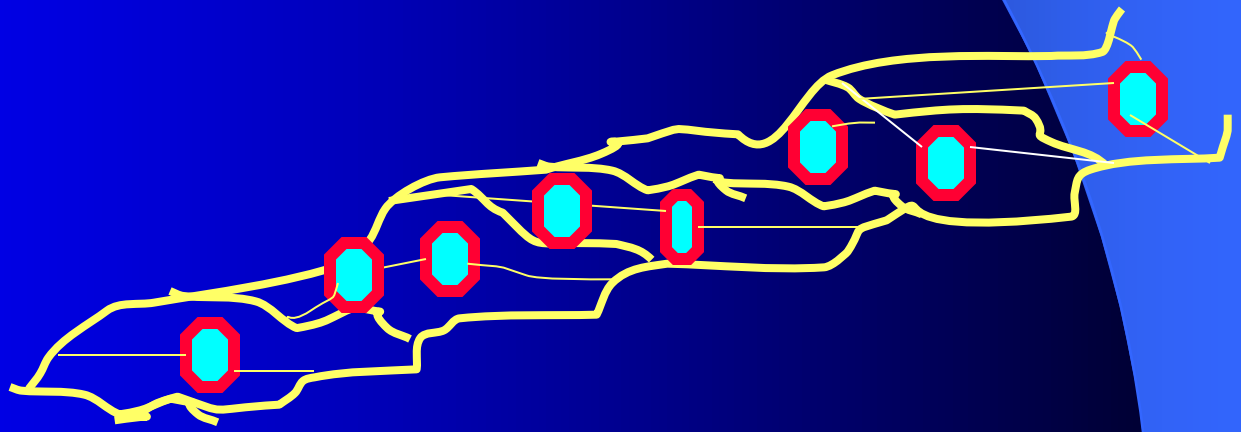
Composites

Chemically bonded mixture of organic matrix and inorganic filler



Composition

- **Organic matrix**

Bowen monomer Bis GMA

UDMA

Oligomer – more flowable (thinning)

TEGMA

Composition

Filler

Milled quartz

Aluminium silicate glass

Silica

Prepolymer

Nanoparticles

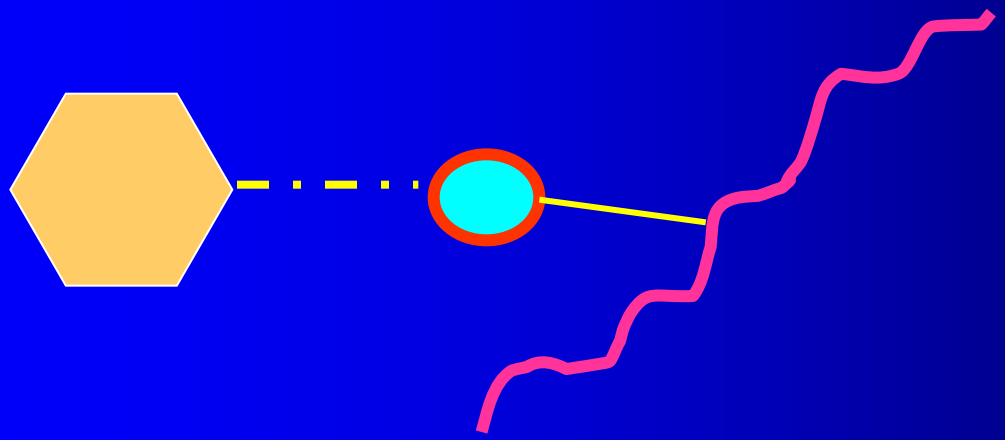
Composition

- **Coupling agent**

Silan

Binding between organic and inorganic part

Homogenous distribution of *filler* in 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 filler)

Classification acc. type of filler

Macrofiller

Microfiller
(pyrogenic SiO_2)

Microfiller-complexes

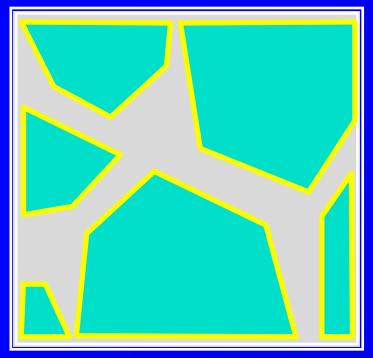
Macrofiller Composite

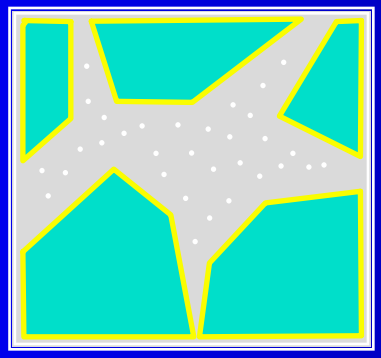
Hybrid Composite

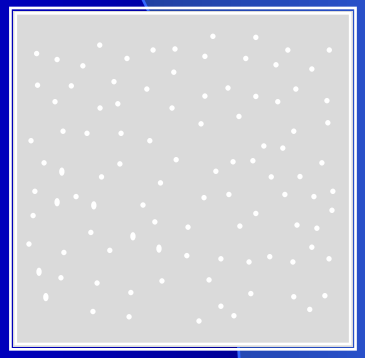
homogenious Microfiller Composite

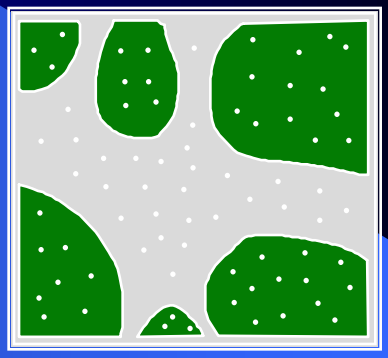
inhomogenious Microfiller-Composite

Nanofiller









Classification according to filler particles

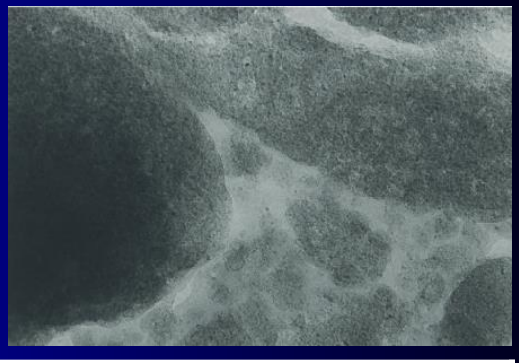
- Macrofiller (macrofilled composites)
- Microfiller (microfiled composites)

-homogenous

-inhomogenous

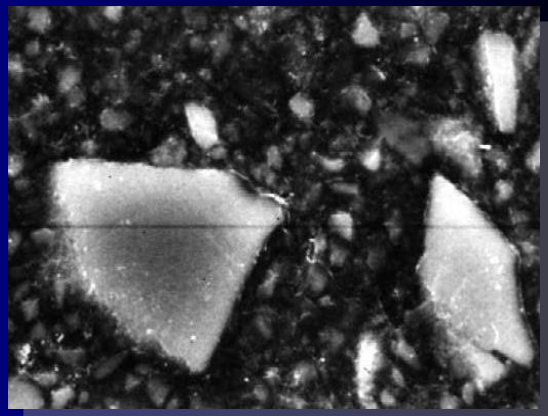
- Nanofiller (nanocomposites)
- Hybride (hybrid composits)

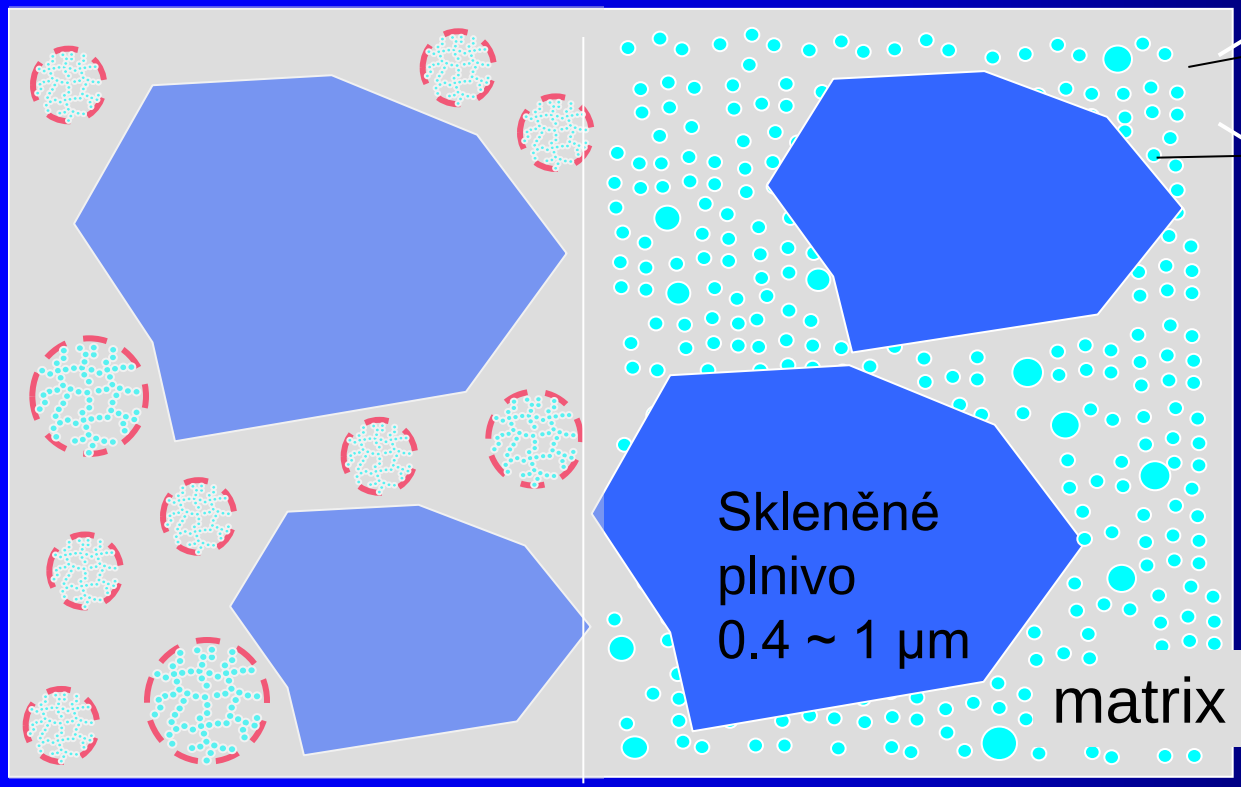
Filler particles

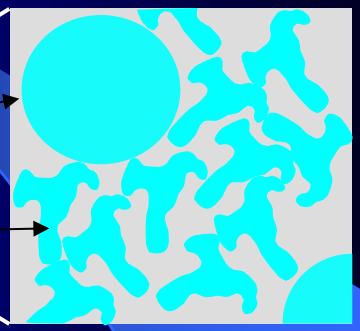


Filler size (medium particle size)	Composite category
< 10 μm	hybrid composite
< 5 μm	fine particle hybrid
< 3 μm	ultrafine particle hybrid
< 1 μm	submicron hybrid , nano composites

Filler - example







More filler
→
Less amount of resin
→
Lower polymerization shrinkage

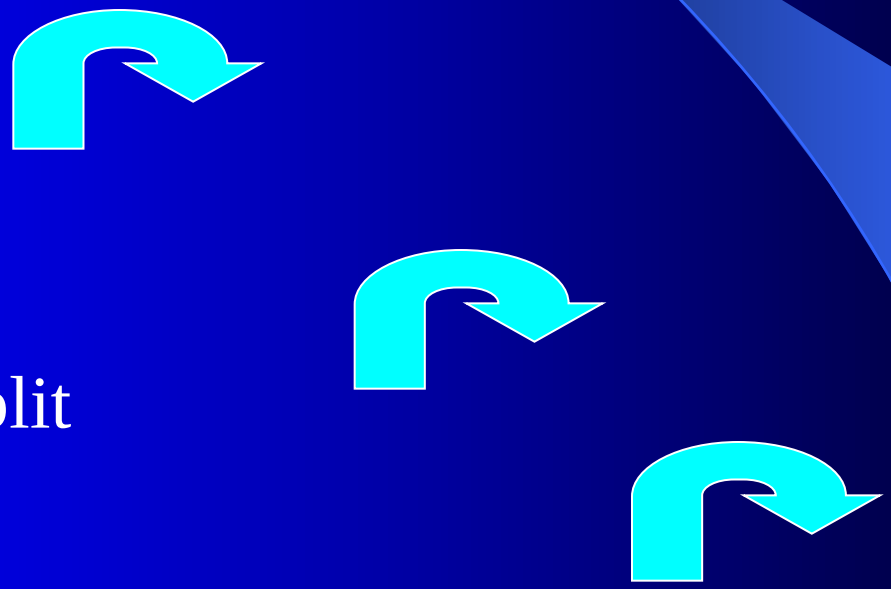
Polymerization reaction

Accelerator

Iniciator

Double bonds – split

Polymer network



Curing

- Light curing composites
- (Light activated).

Light activation is accomplished with blue light (470 nm)

Initiator is camphorquinon

Chemically cured composites

Iniciator is organic peroxide, accelerator tertiary amine

Classification acc to mode of curing

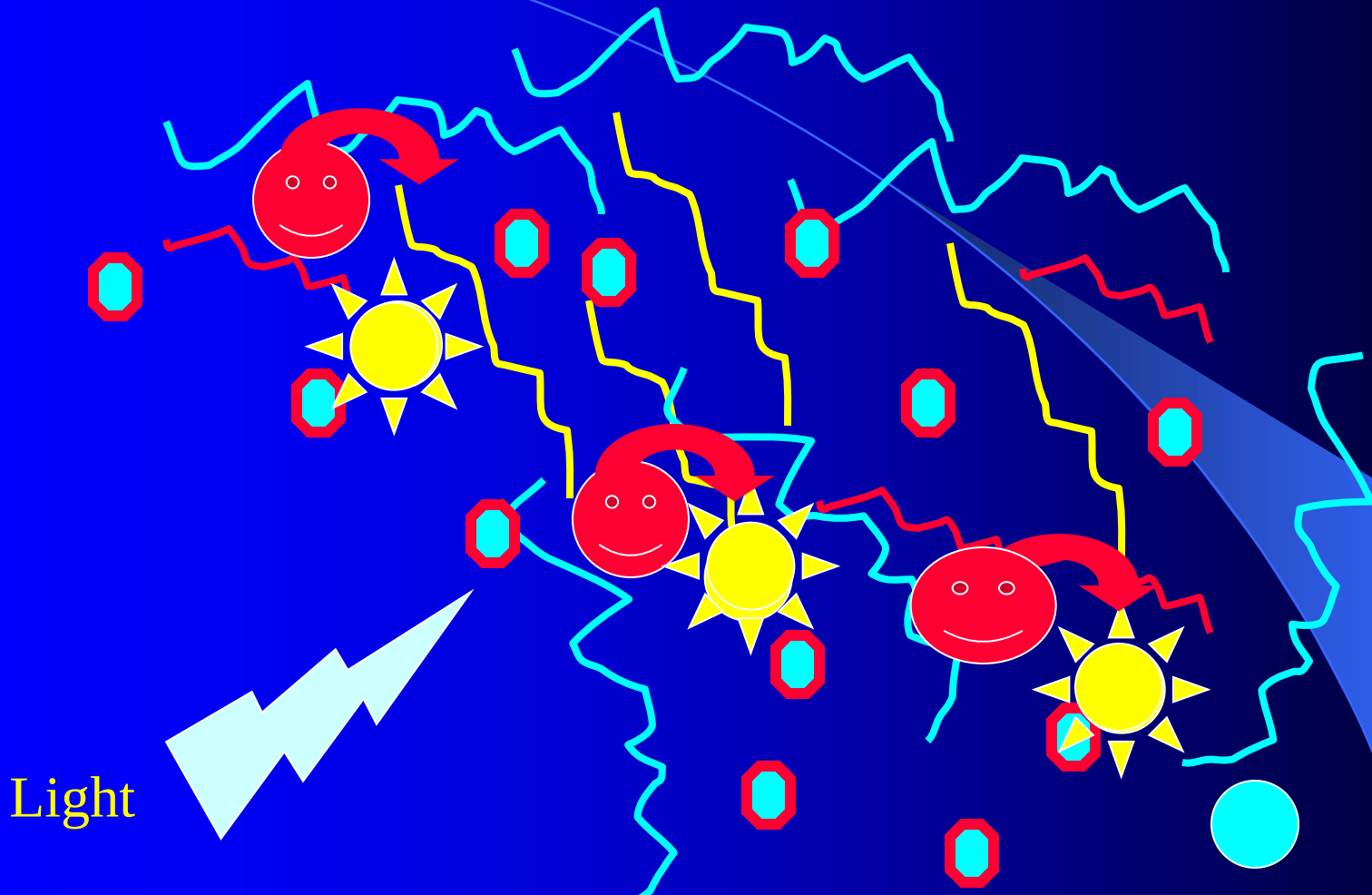
- Light curing
- Self curing (chemically curing)
- Dual curing (cementzs)
- Heat curing (for dental lab)

Polymerization units

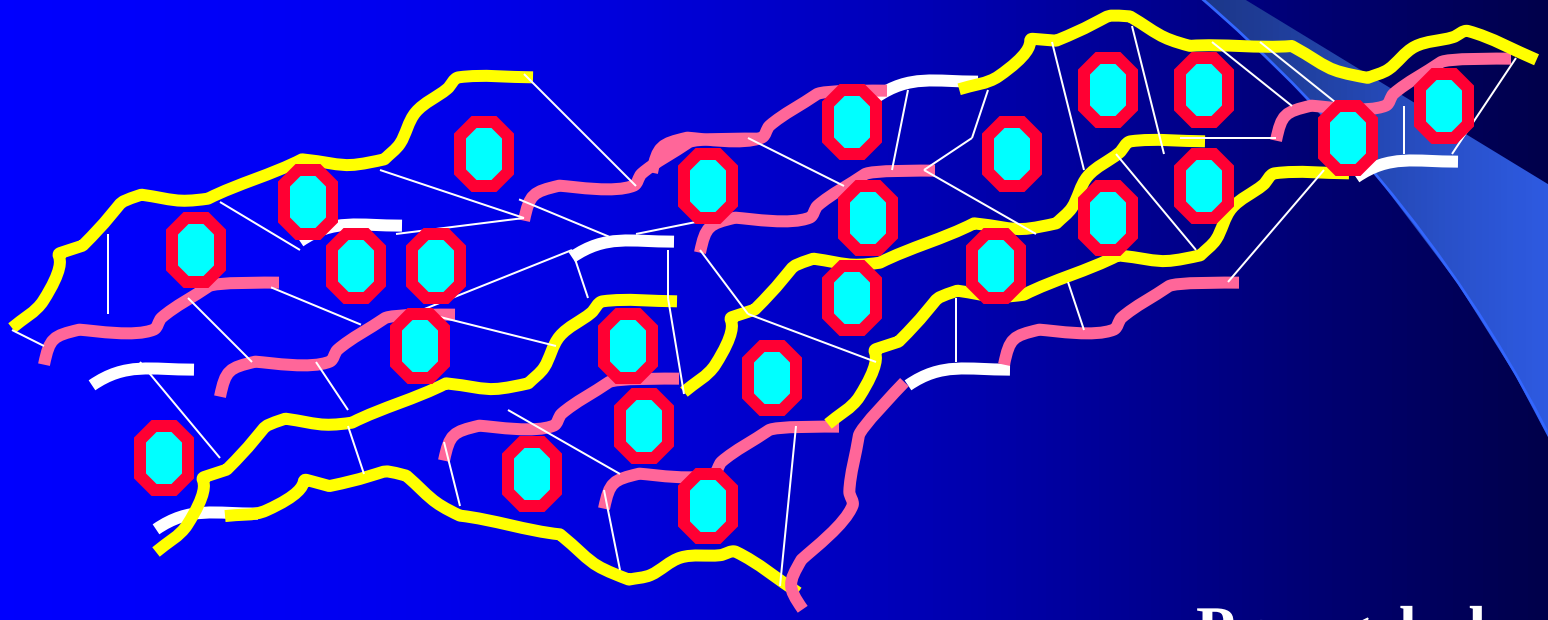
- Quartz halogen units
- LED units

Blue light, 400 – 500 nm.

Camphorchinon 470 nm (maximum absorption)


Light

Polymer network



Polymerization shrinkage

Pre –gel phase
Gel-point
Post –gel phase

Indications

- Frontal area:

Class III., IV, V.

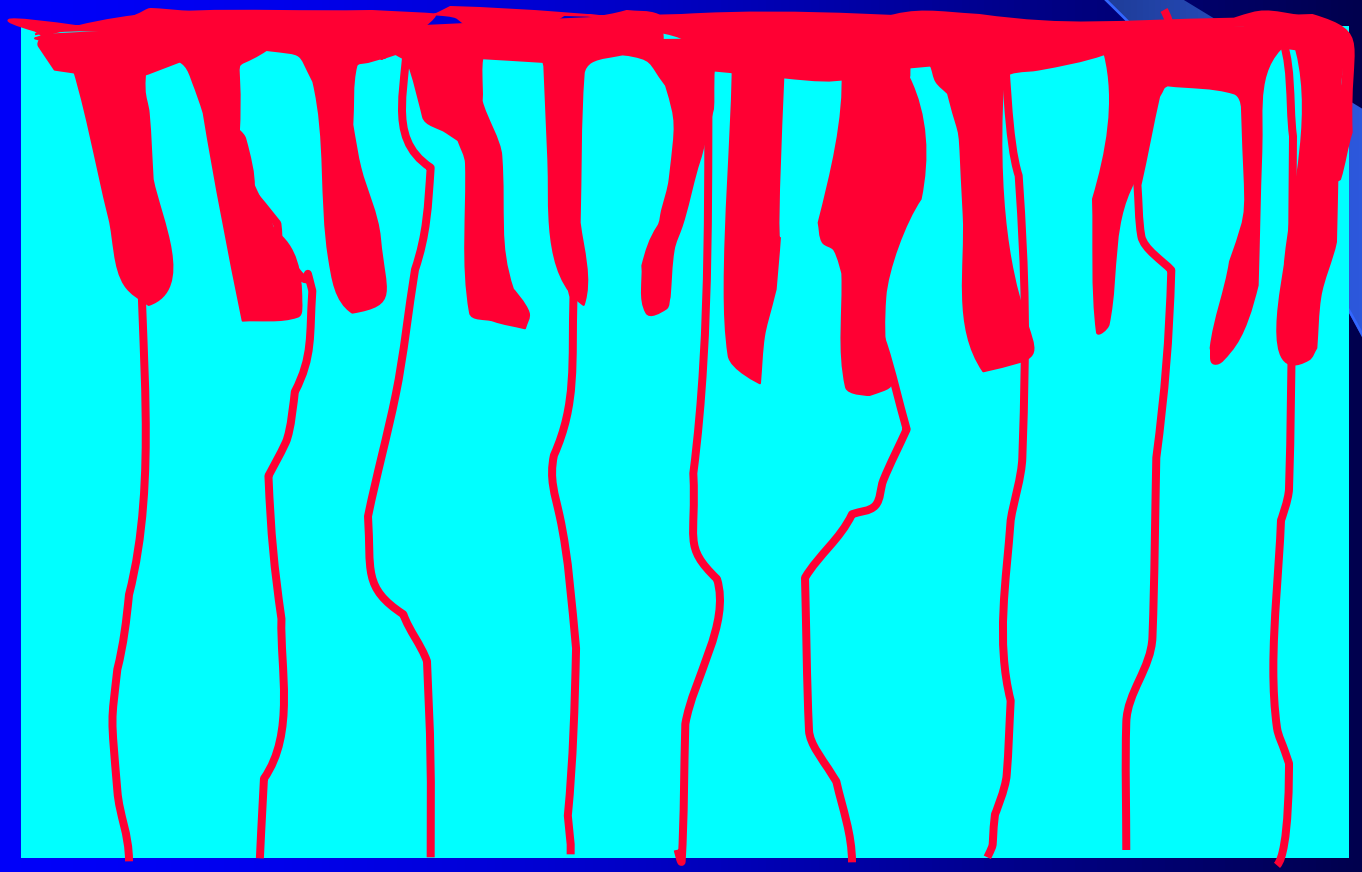
Posterior area

Small – moderate cavities I. and II. class

Contraindications

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

Principle of retention - micromechanical

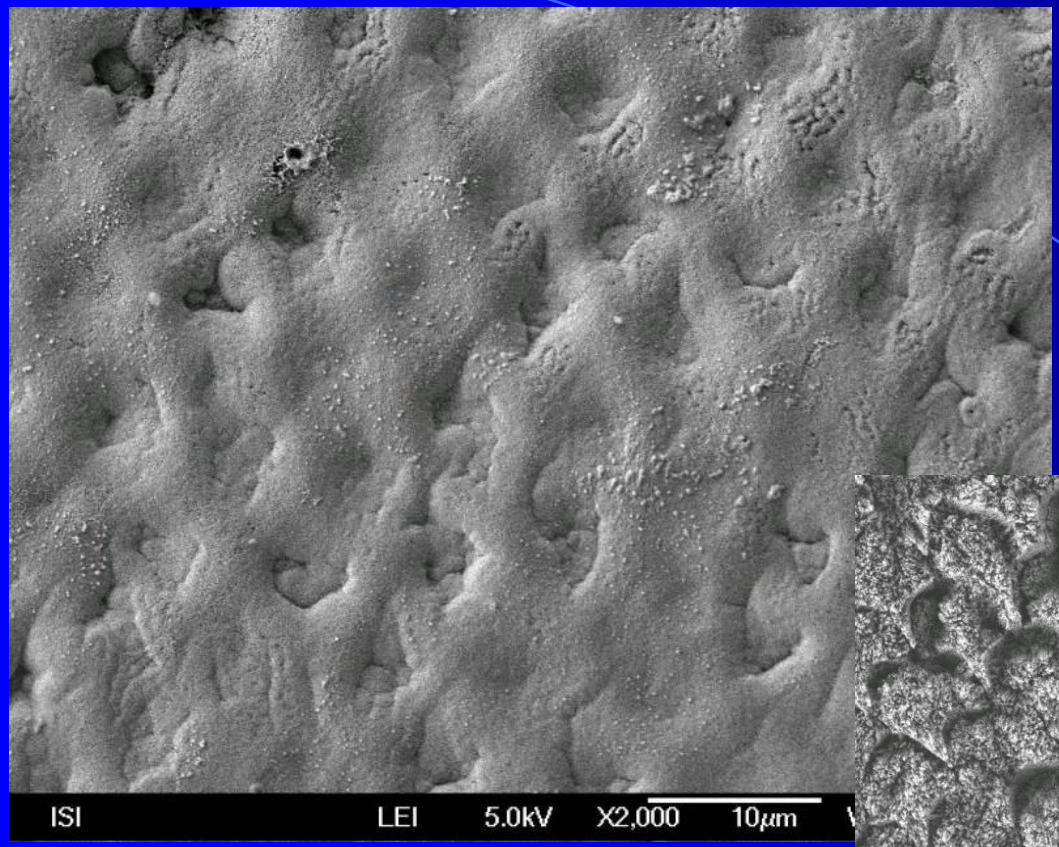


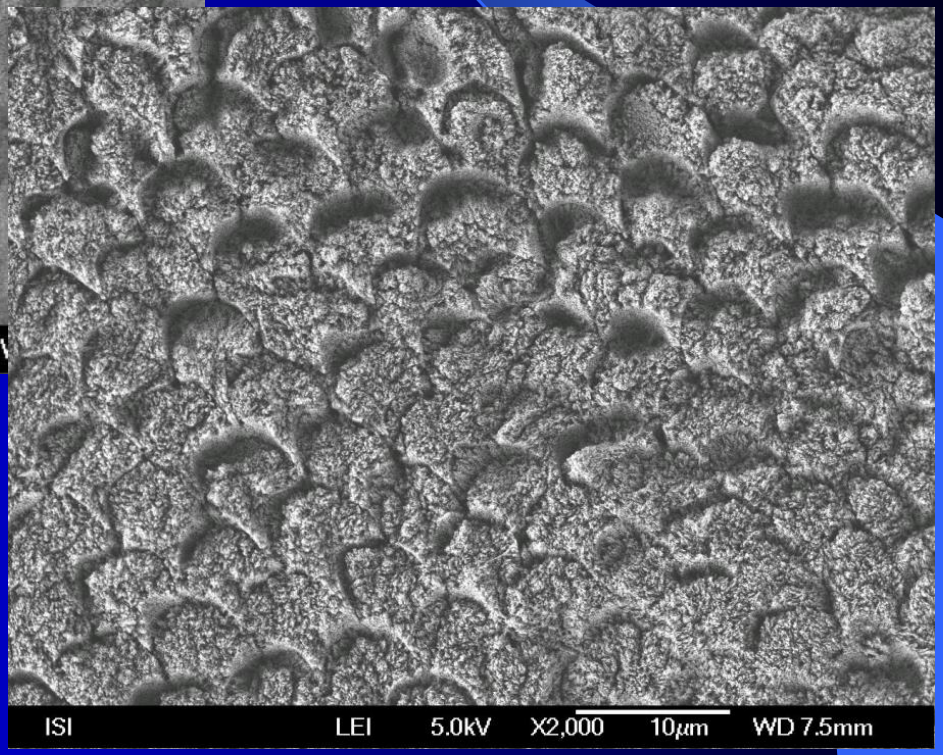
Micromechanical retention

- Adhesion – two surfaces (adherends) are bound together with thin layer of adhesive
  - **Mechanical**
  - Physical (intermolecular forces – van der Waals)
  - Chemical (chemical binding)

Clinical histology

- Enamel
- Hardest dental tissue 98% inorganic substances – hydroxyapatit
- Ectodermal origin, formed by ameloblasts
- Basic unit of enamel – enamel rods (prismatic structure), between enamel rods interprismatic substance.
- On the surface aprismatic enamel.

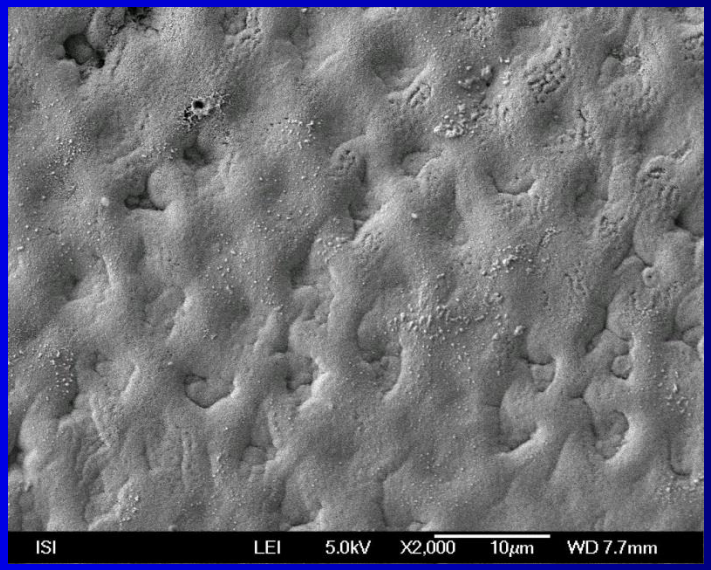

ISI
LEI
5.0kV
X2,000
10μm


ISI
LEI
5.0kV
X2,000
10μm
WD 7.5mm

35% - 37% phosphoric acid
silica particles
blue dye

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)



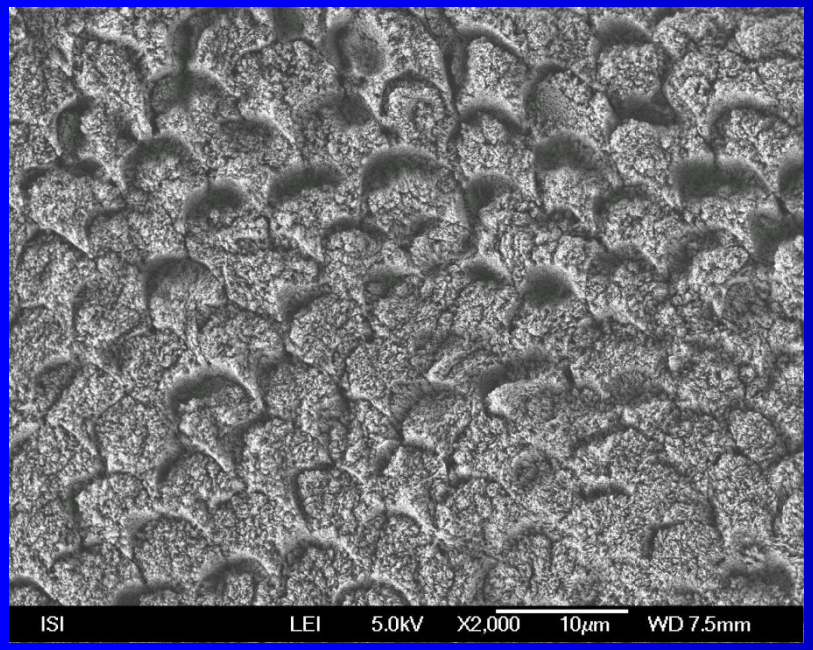
Retention in enamel

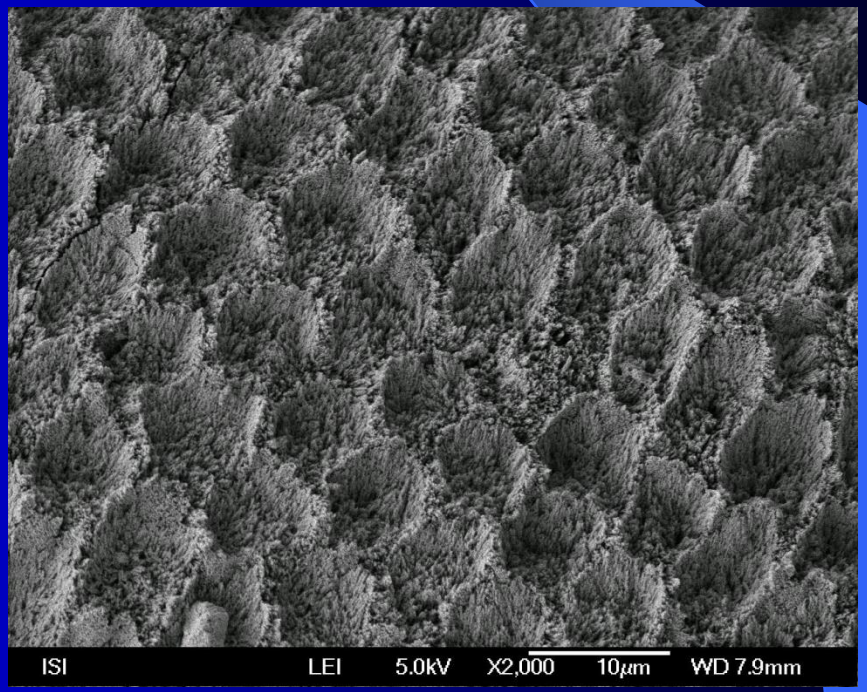
Acid etching of enamel

Irregular surface – retentive pattern

Speces between enamel rods or in enamel rods are created

The material flows into these spaces



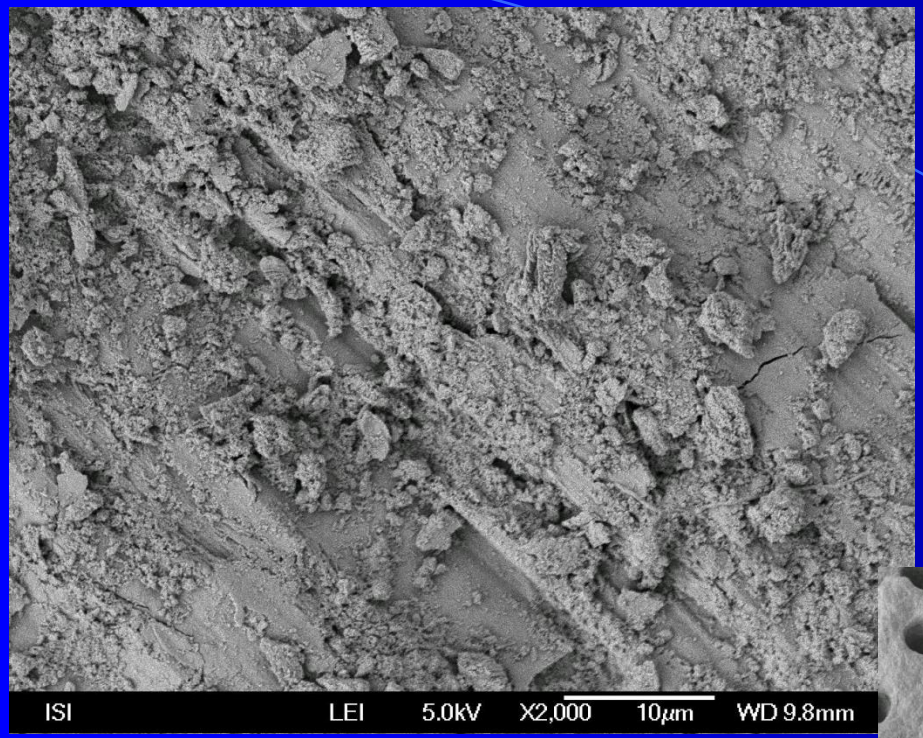


Clinical histology

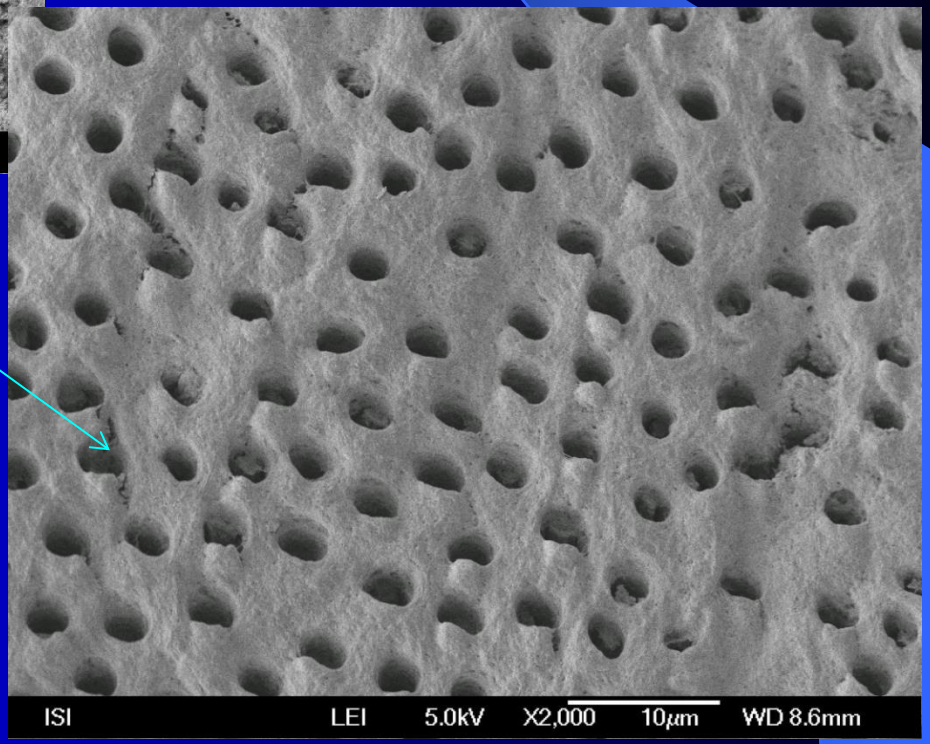
- Dentin hard dental tissue – core, mesenchymal origin, appr. 75% inorhanic substances (hydropxyapatite)
- Similar to bone, without blood support.
- Structure: collagen fibers, incrusted with hydroxyapatite.
- Dentin tubuls – connection with dental pulp
- Dentinal liquor,Tomes fibers, nerve fibers.

Retention in dentin

- 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)

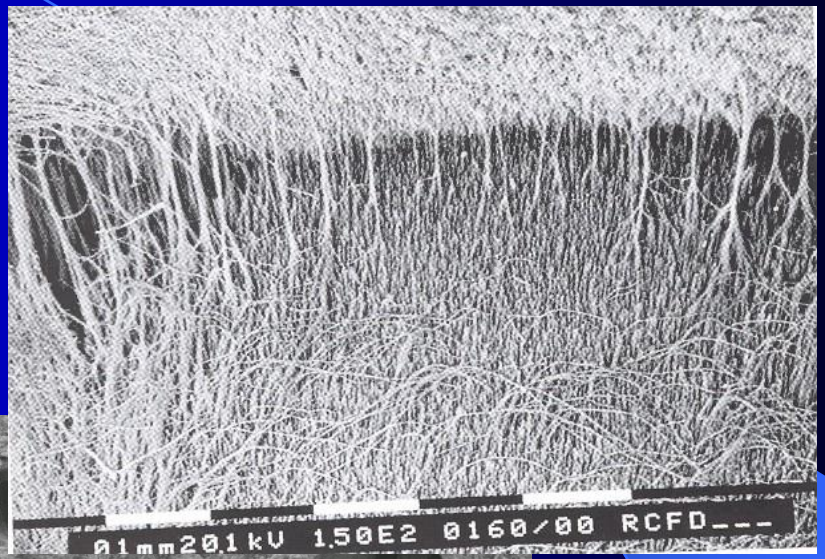


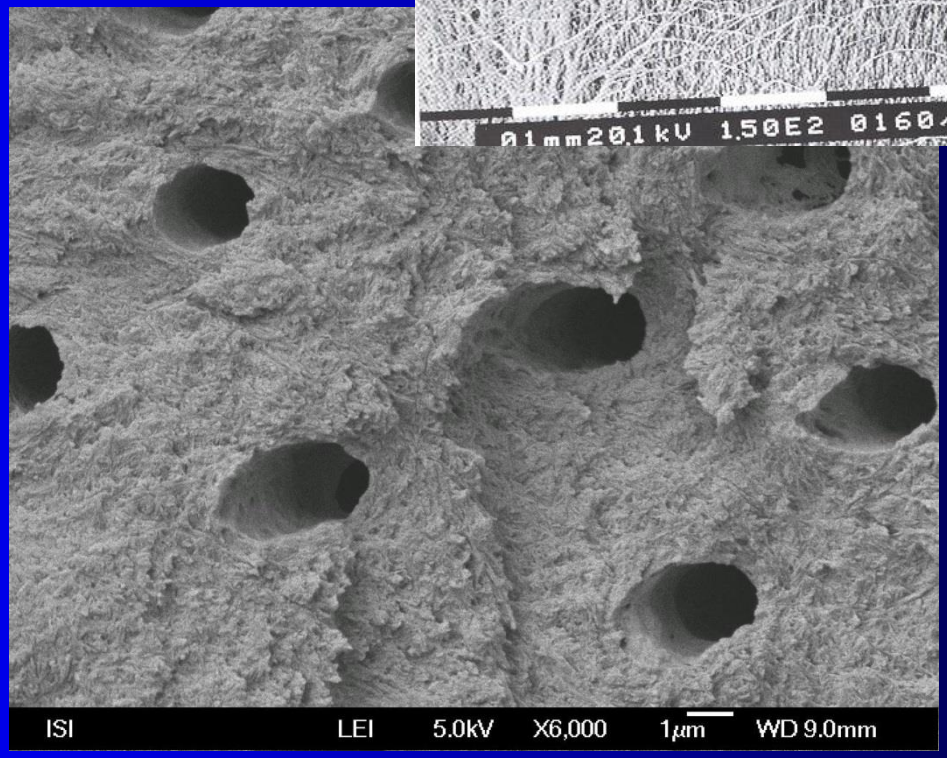
Smear layer



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





35% - 37% phosphoric acid
silica particles
blue dye

Adhesive system

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

It consist of primer and bond

Bond

- **Flows into spaces in enamel after etching, into dentin tubules and to spaces in collagen network. Dentin must be pretreated with primer.**

Primer

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

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

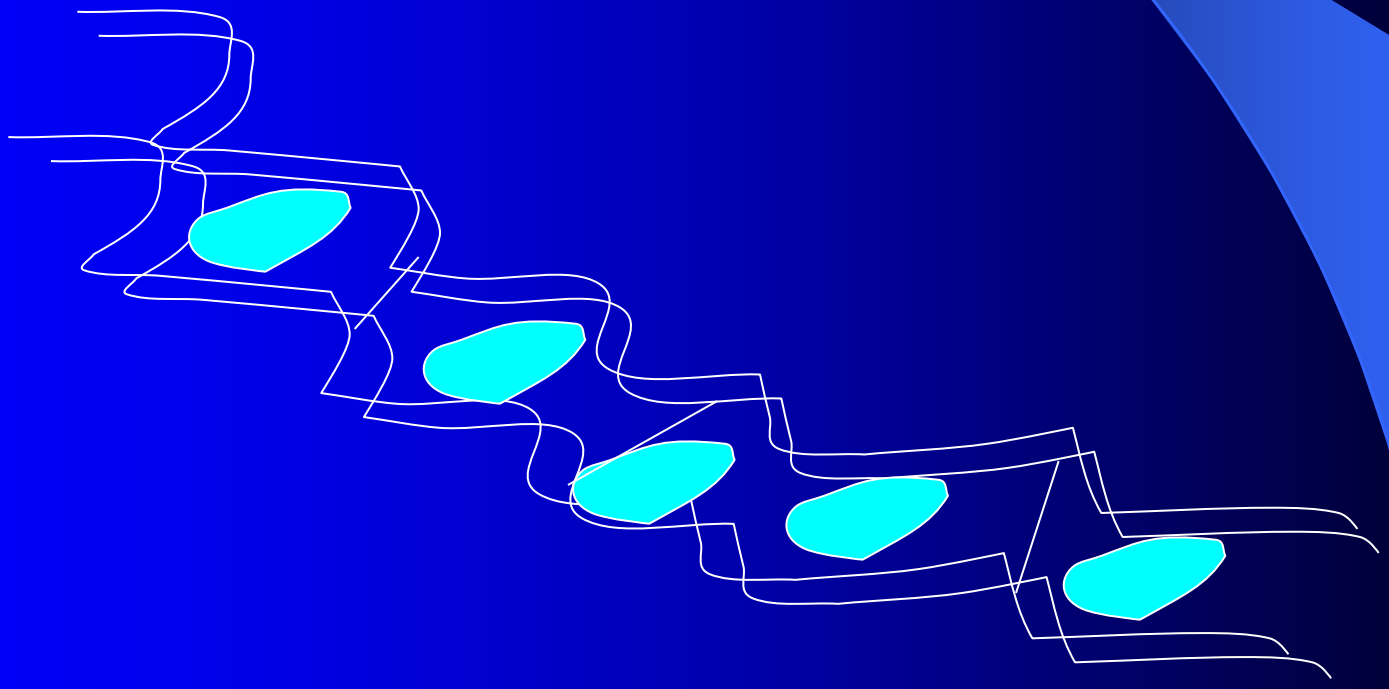
Composition

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

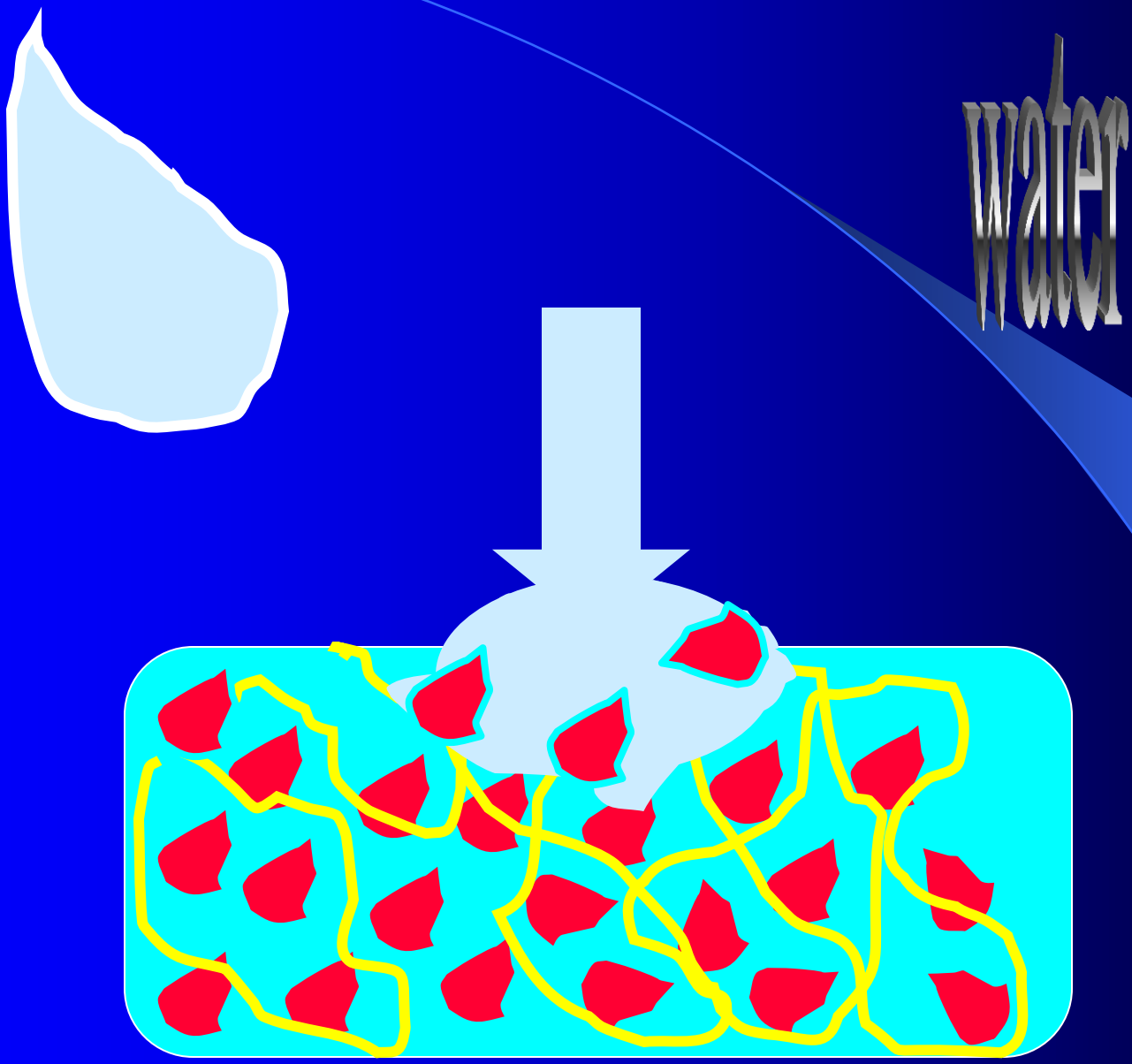
Mechanical not strong enough

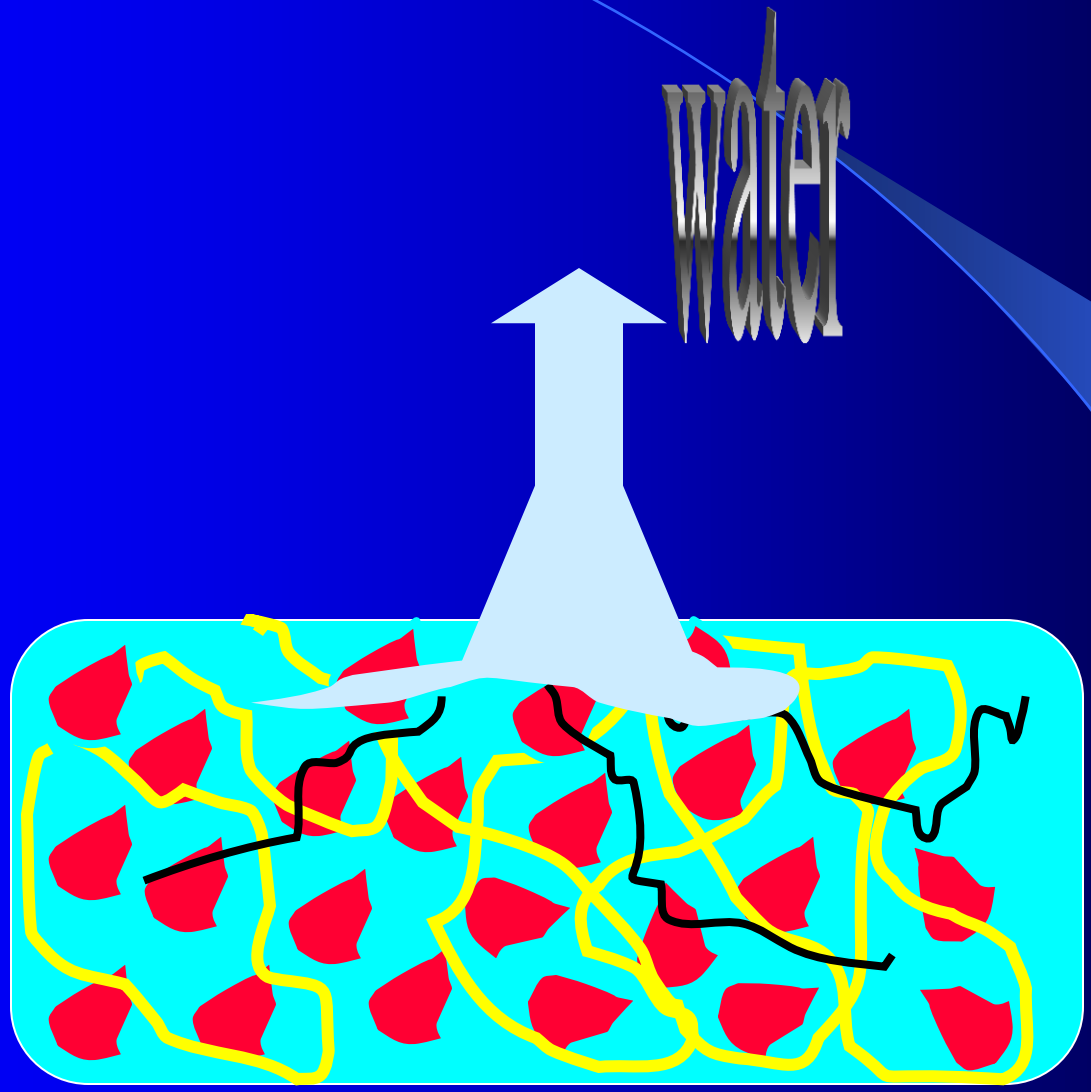
Aesthetics acceptable

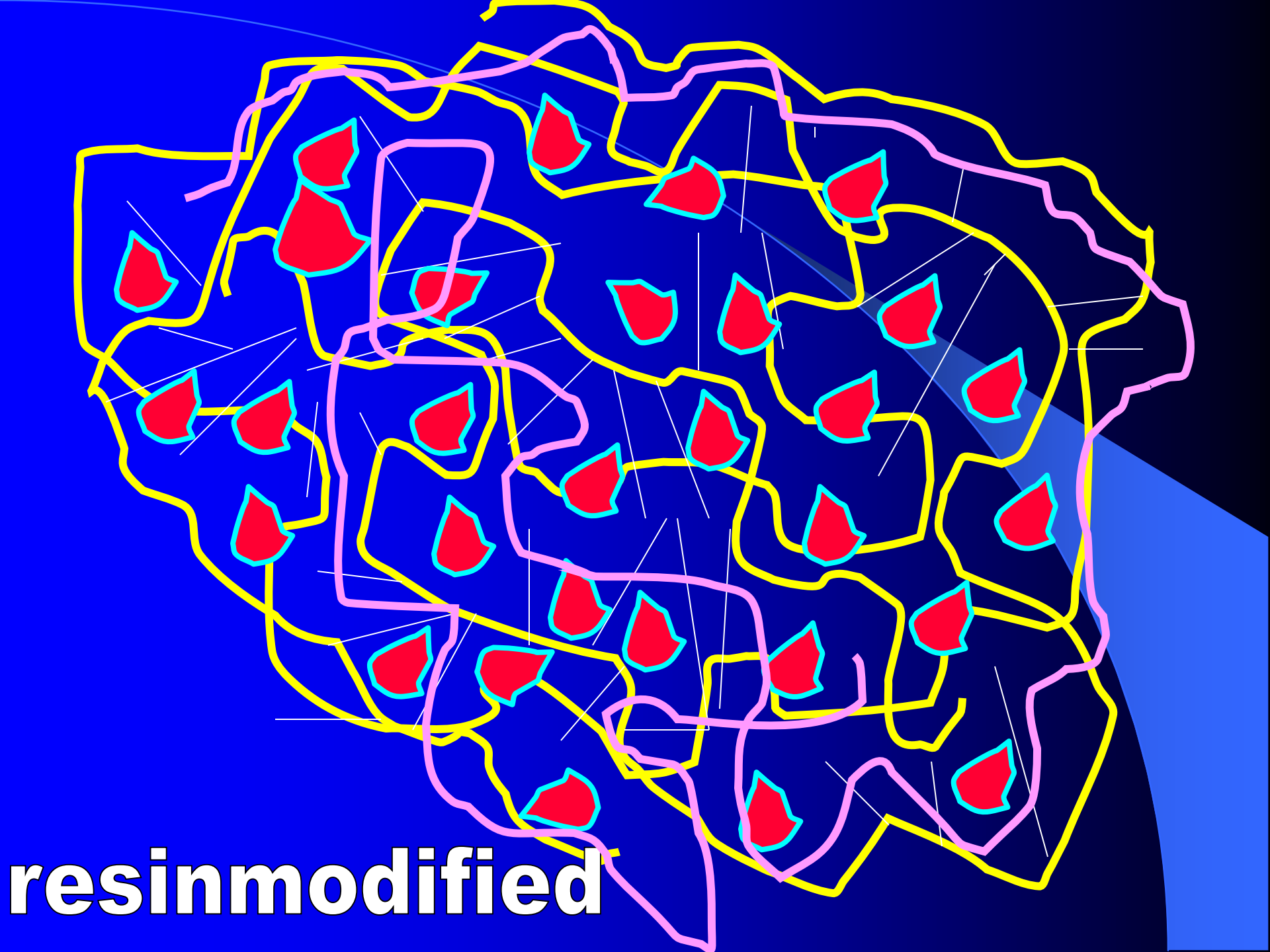
Glassionomers acc to curing

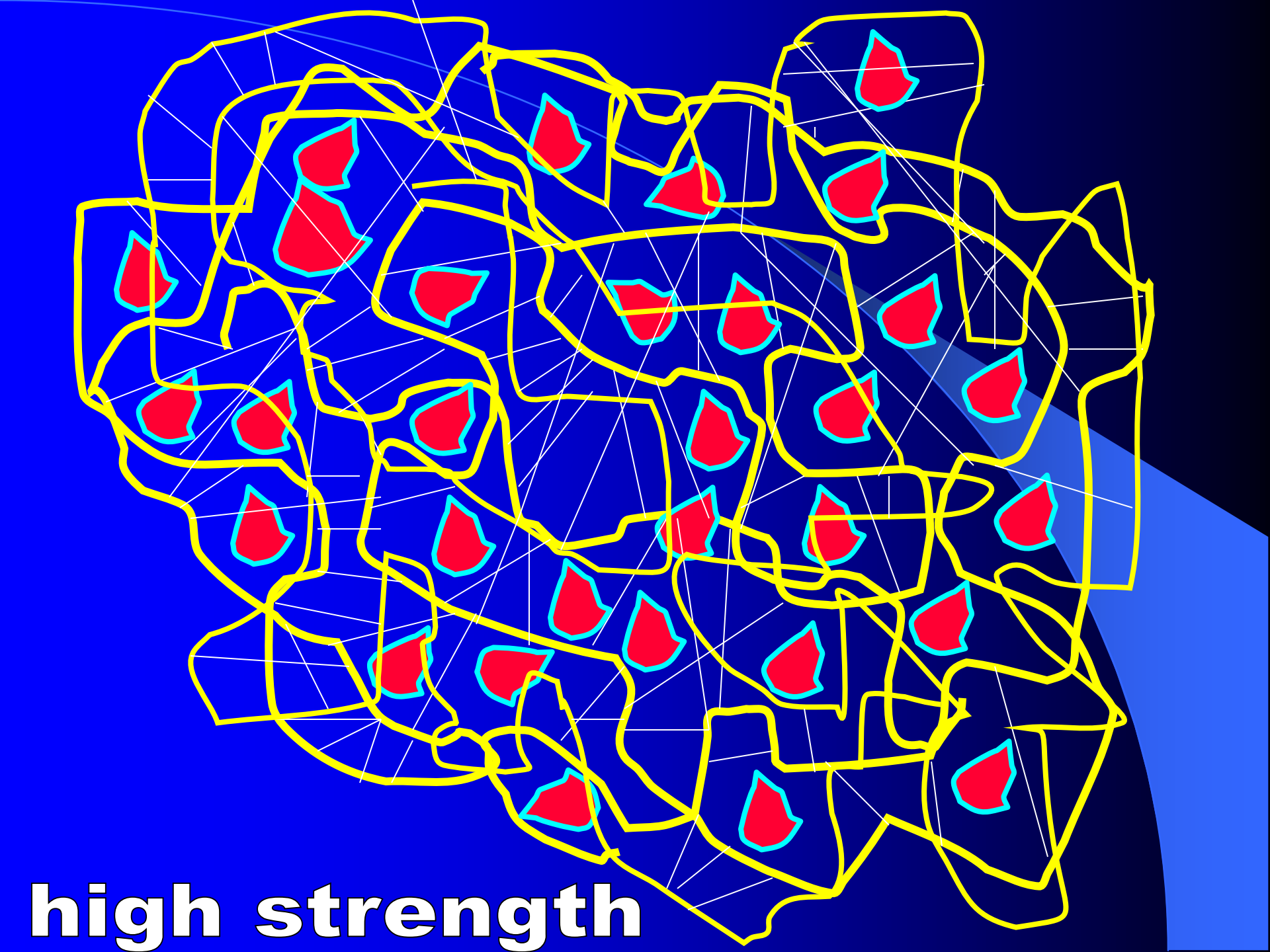
- Acid – base reaction
- Dual cured glassionomers (resin modified)


dentin


water


water


resinmodified


high strength

Glassionomers - indications

- Fillings

Class V., III., I., II

Sealants

Protection of tooth surface

Mixing

Hand

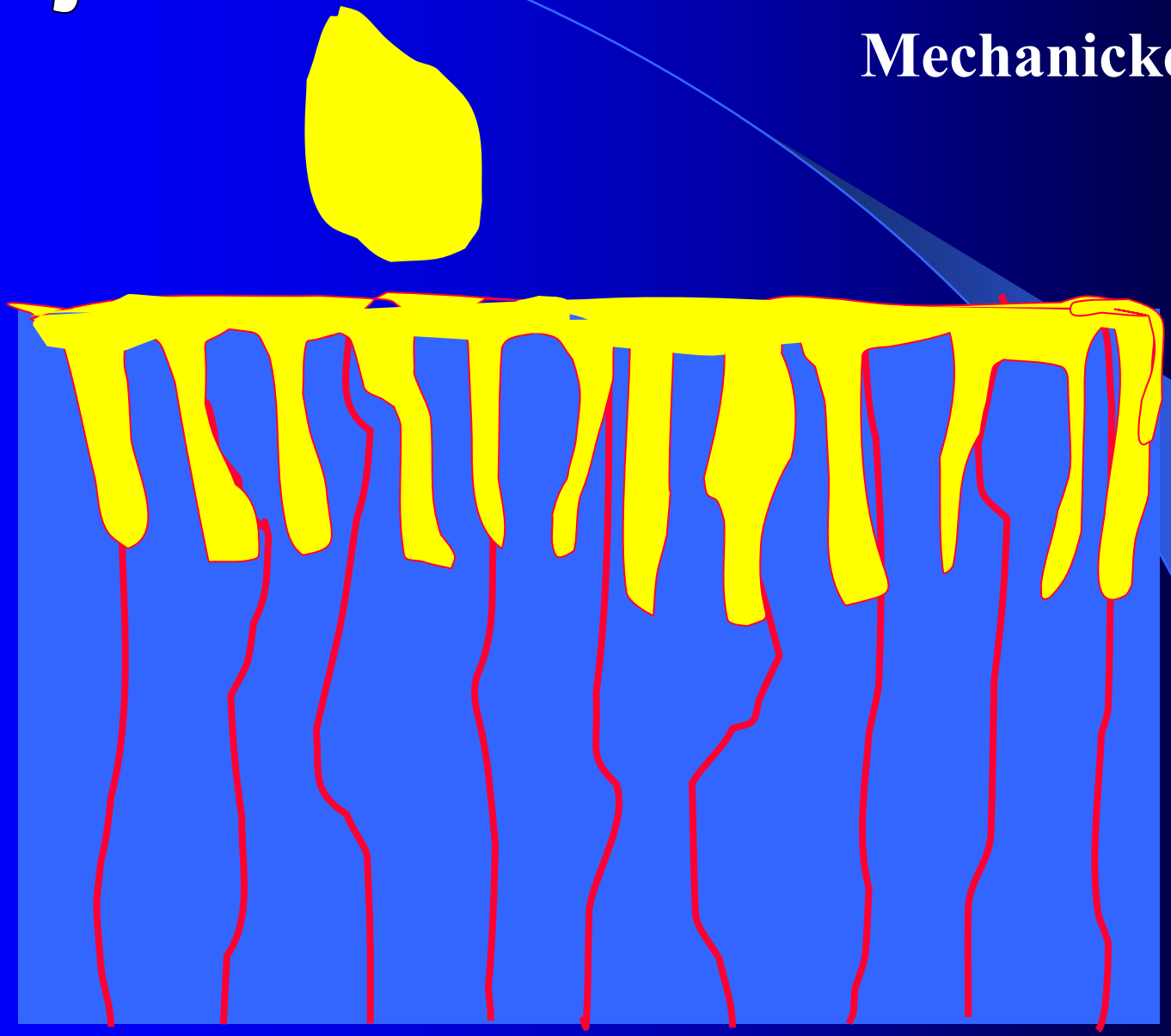
Power driven - capsulated

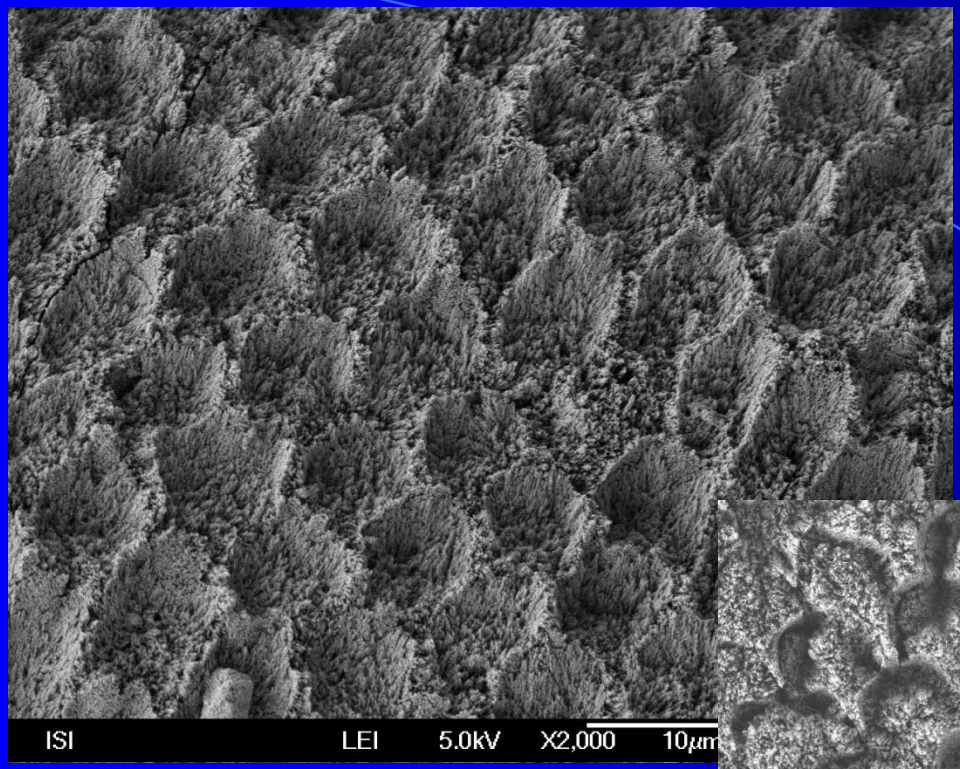
Making filling

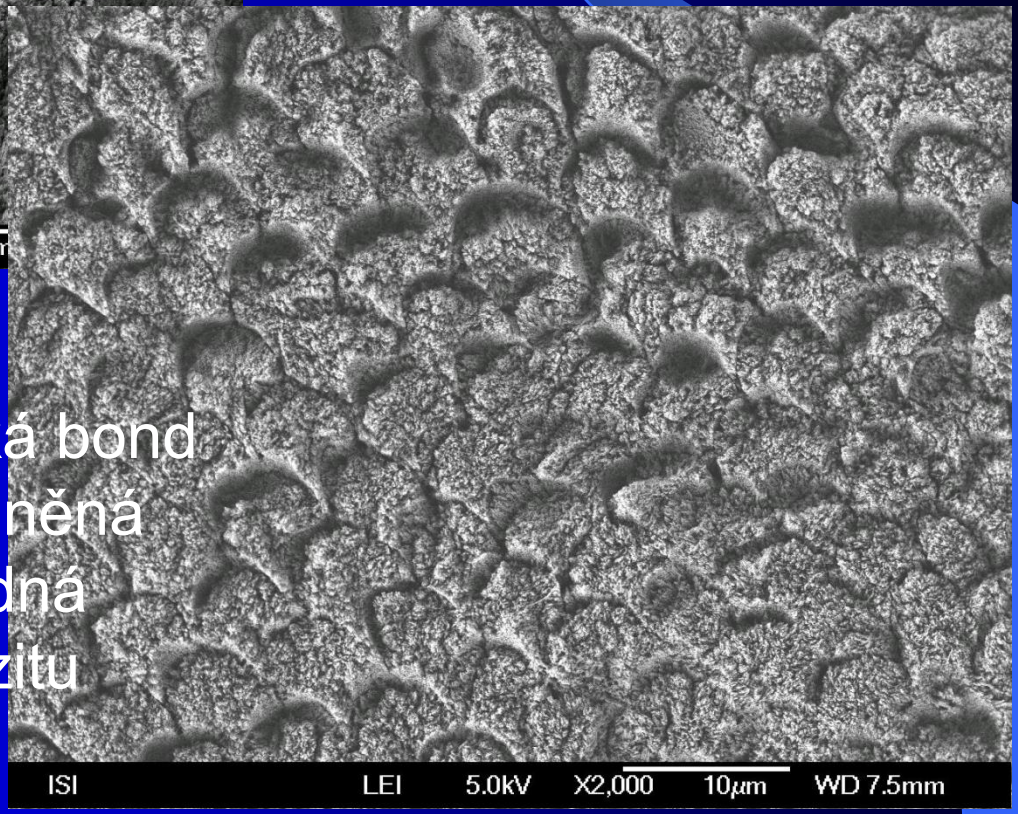
- Preparation
- Smoth bordes
- Limited on caries lesion only
- Conditioning
- Washing
- Filling in one block
- Varnish after setting
- Polishing in next appointment

Připojení ke sklovině

Mechanické





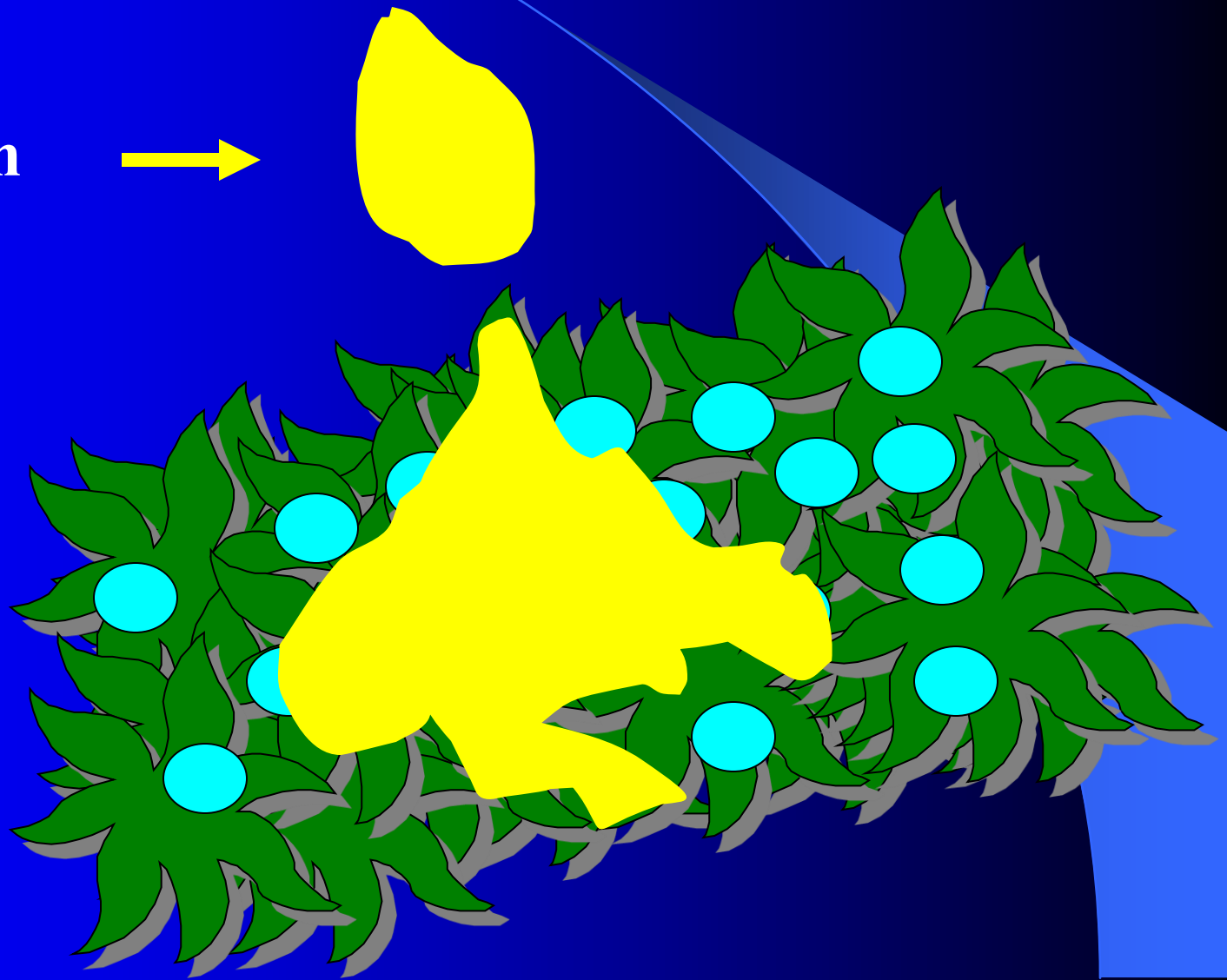


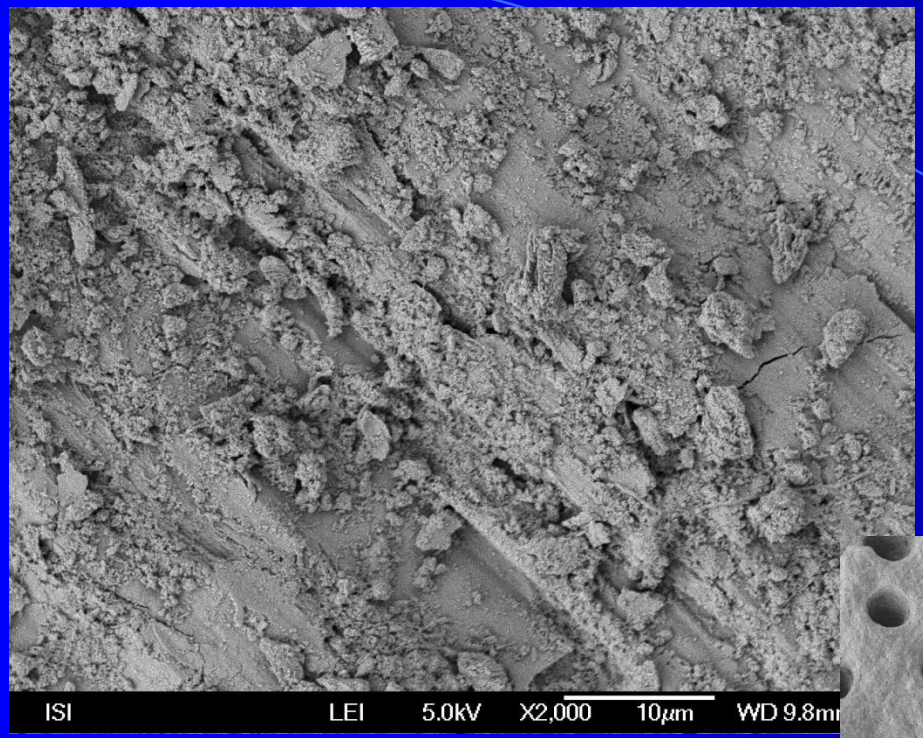
Do mikroskopických nerovností skloviny zatéká bond – neplněná nebo nízkoplněná pryskyřice chemicky shodná s organickou fází kompozitu

Připojení k dentinu

Převážně mechanické

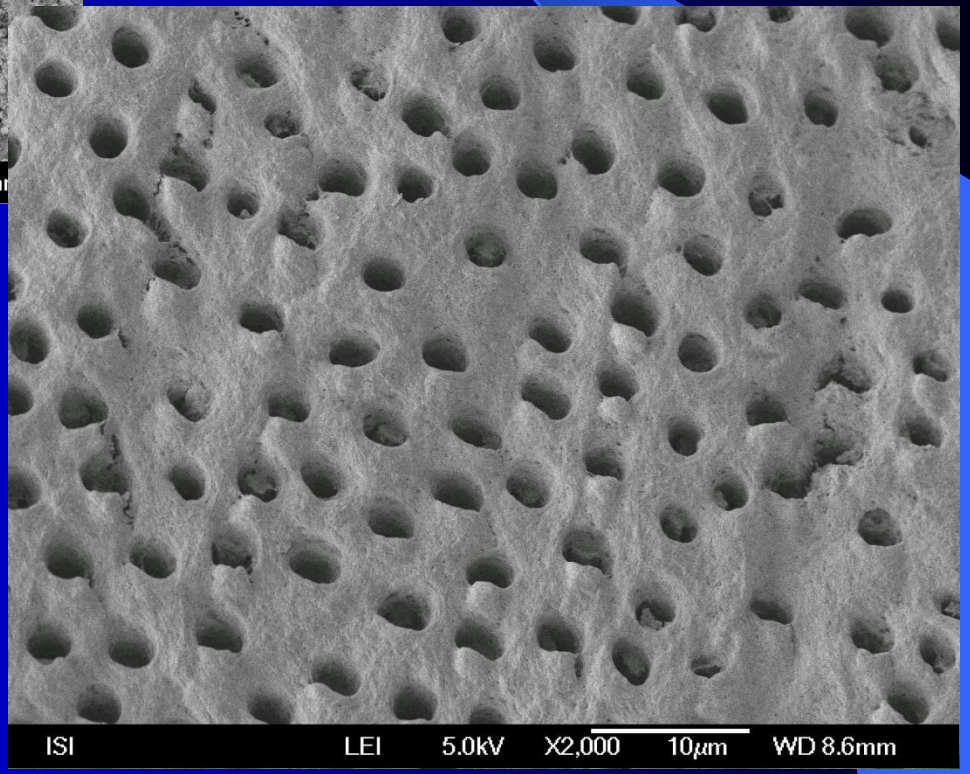
Vazebný systém

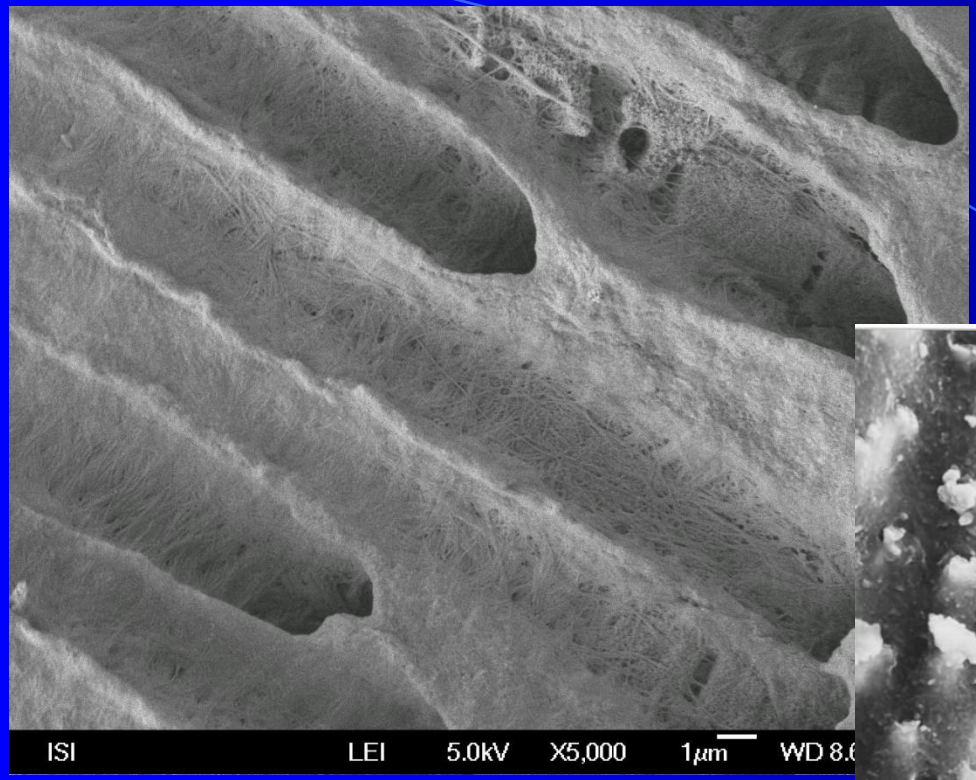


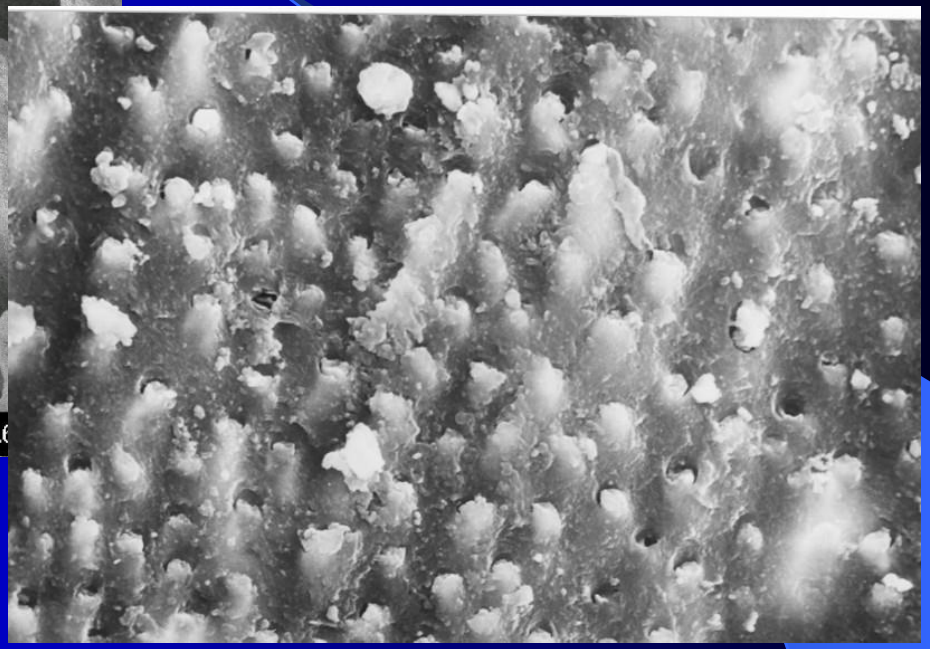


Smear layer

Dentin po ošetření kyselinou




ISI
LEI
5.0kV
X5,000
1μm



Dentin

- Má méně anorganických látek než sklovina
- Vyšší obsah vody
- Nízká povrchová energie

Nelze smáčet hydrofobním bondem. Je riziko, e kolagenní síť zkolabuje a vznikne netěsnost.

Proto je třeba primer.

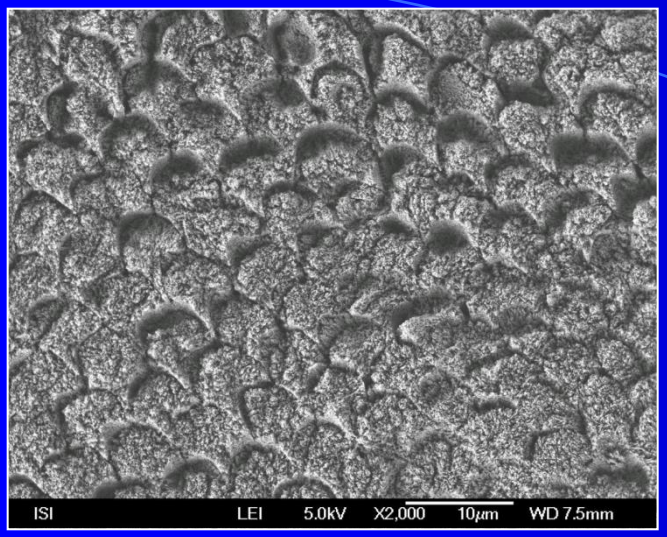
Primer

Otvírá kolagenní síť dentinu a brání jejímu kolapsu.

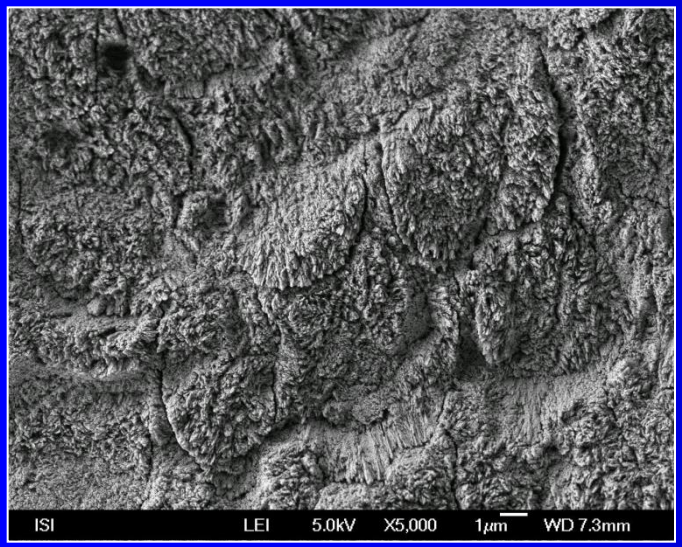
Obsahuje amfifilní pryskyřice (mají hydrofilní a hydrofobní část molekuly) a rozpouštědlo. Rozpouštědlo se odpaří a primer prosytí dentin. Jeho hydrofobní část kopolymeruje s kompozitem.

Bond

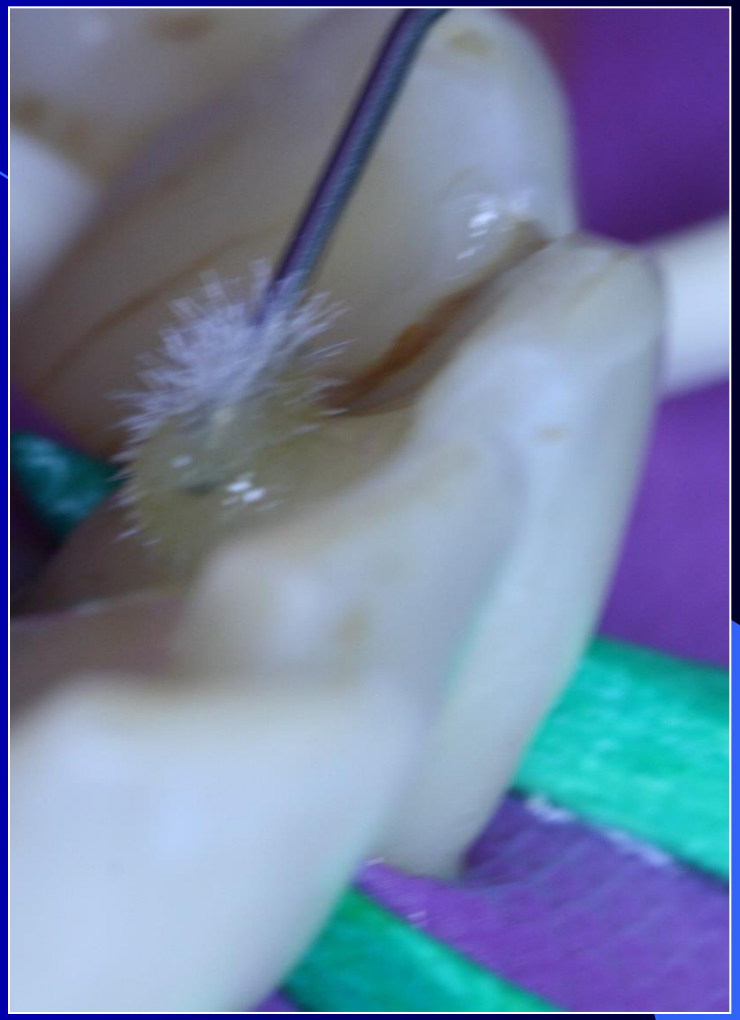
- **Prosytí kolagenní síť dentinu ošetřenou primerem a zatéká do nerovností ve sklovině, kopolymeruje s kompozitem .**

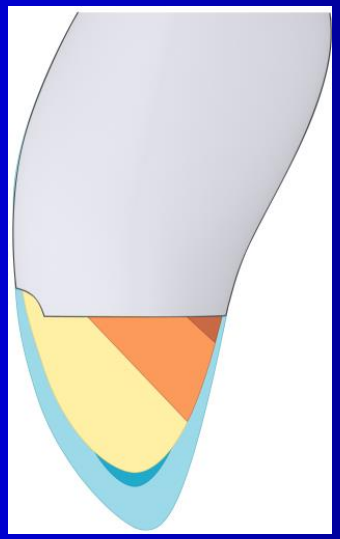


TE



SE





Kompozitní výplň –pracovní postup

- Preparace kavity –hlubší miska
- Sklovinné okraje obvykle sešikmíme v úhlu 45°

Kolem kavity preparujeme retenční pruh (odstraněné aprizmatické skloviny, která je na povrchu a hůře se leptá)

Leptání skloviny 20 – 30s

Leptání dentinu 10s

Oplachování minimálně 10s

Primer+bond

Polymerace vrstvení kompozitu (1,5 – 2 mm

Opracování a leštění (diam.brousky a gumové leštící pomůcky).

Skloionomerní cementy (sklopolyalkenoáty, skloionomery)

- **Složení:**

Prášek: hlinitokřemičité sklo (SiO_2, Al_2O_5, CaO, N_2O,P_2O_5, F)

Tekutina:

polykyselina (kyselina polyakrylova, polymaleinová)

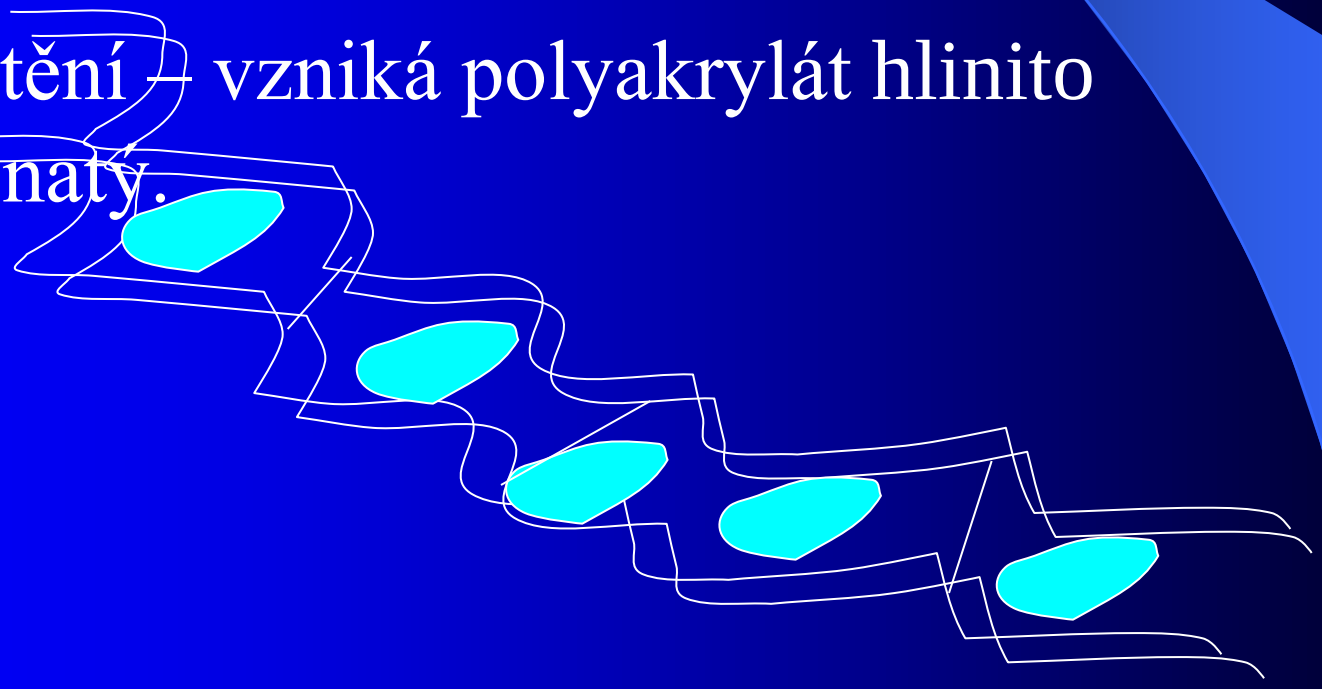
kyselina vinná,

voda

Skloionomerní cementy (sklopolyalkenoáty, skloionomery)

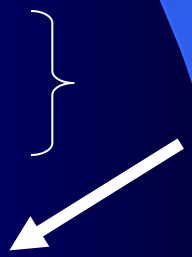
- Mechanismus tuhnutí:

Síťovatění – vzniká polyakrylát hlinito vápenatý.



Skloionomerní cementy vlastnosti

- Specifická adheze k tvrdým zubním tkáním
- Příznivý koeficient tepelné roztažnosti
- Kumulativní uvolňování fluoridových iontů
- Citlivost k obsahu vody v prostředí
- Delší doba tuhnutí zranitelnost



Skloionomerní cementy rozdělení

- Tuhnoucí chemicky

Výplňové estetické

Výplňové zesílené – kovy, pryskyřicí

Vysokoviskózní cementy !

- Tuhnoucí světlem – obsah plastu s vazbou na polykyselinu!

Skloionomerní cementy použití

- Výplně

V. třída, III. Třída, výjimečně I.a II. třída

- Podložky – sendvičové výplně
- Dostavby
- Tmelící materiál
- Výplň kořenového kanálku (kořenová výplň)

Skloionomerní cementy

- Ručně míchatelné

Mísící poměr – kapka bez bubliny!!!!

- Kapslované – aktiovace kapsle. Kapsle mísící, kapsle aplikační.

Režim míchání!!!!

Dokonalé zacházení!!!

Skloinomerní cementy – postup zhotovení výplně

- Preparace kavity – hlubší miska, okraje ohlazeny. Nešikmí se.

- Ošetření kondicionérem (kyselina polyakrylová, 20s)
- Aplikace materiálu najednopu do vlhké kavity.
- Po ztuhnutí nalakování, neleští se.
- Opracování v další návštěvě.