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Frametime :
stabilization, protection and drug delivery, a biomimicry approach to emulsion.

Fabrizio Fordiani , PhD

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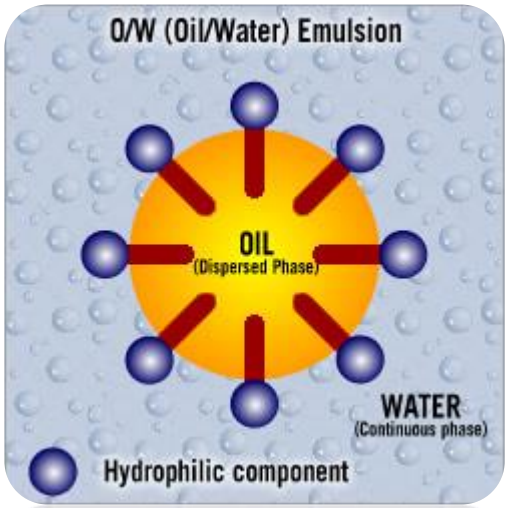
Emulsions and emulsifiers

Emulsions are pseudo stable mixtures of immiscible liquids where one liquid contains a dispersion of the other liquids



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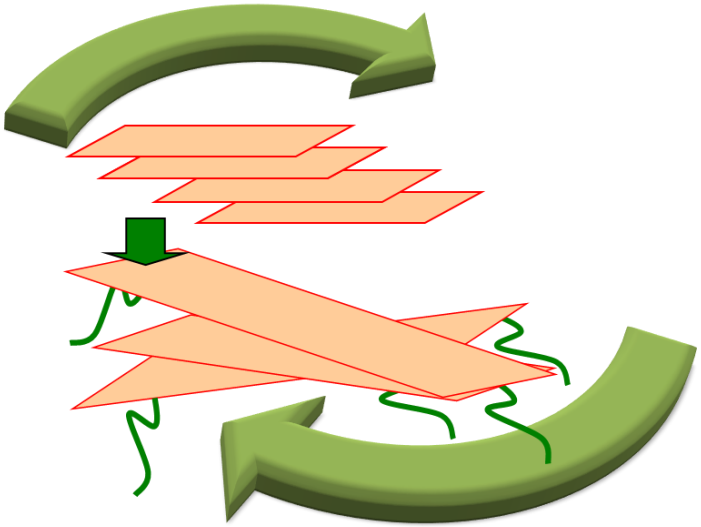
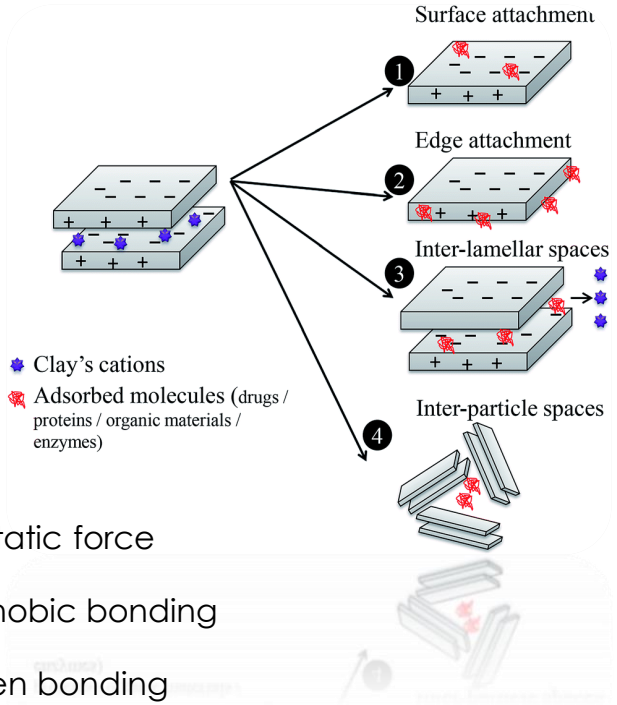
Frametime emulsions = physical stabilization





- Electrostatic force
- Hydrophobic bonding
- Hydrogen bonding
- Ligand exchange
- Water bridging

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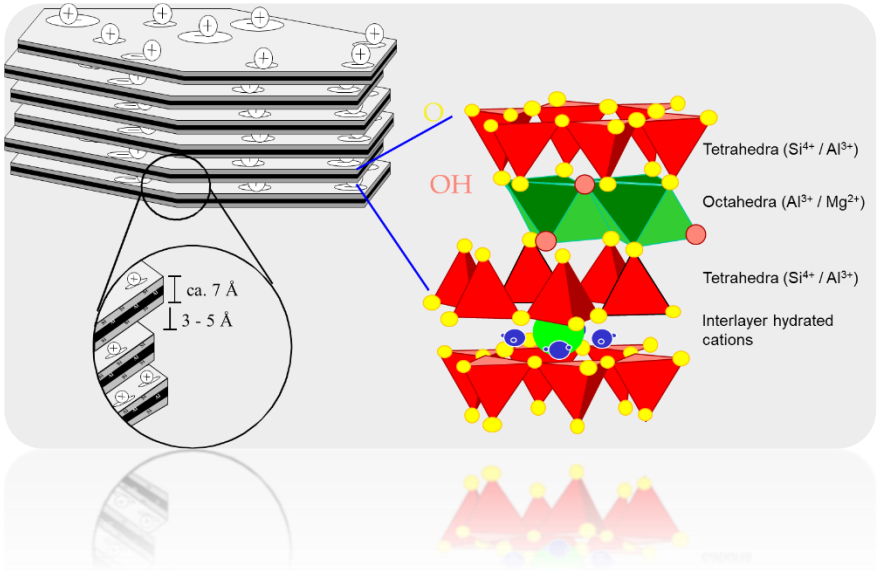
The lamellar mineral structures

- Lamellar mineral:
  - **High Specific Area: > 300 m^2 /g**
  - **VS (Human body Skin surface < 2m^2)**
- High adsorption capacity
- Inert & Non-toxic support
- Swelling capacity
- Biomoluecules interaction
- Encapsulation capacity
- Refractive material = UV protection
- Heat resistant material = thermal protection
- Rheological Modifier



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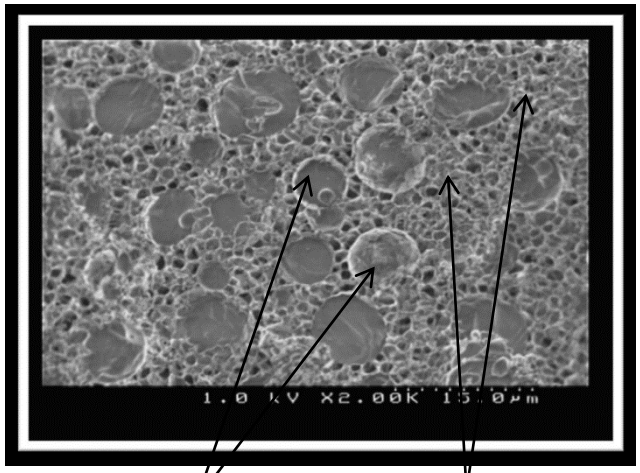
Frametime emulsion, physics vs chemistry

Pickering emulsion is obtained by using an organic–modified natural clay: Frametime®.

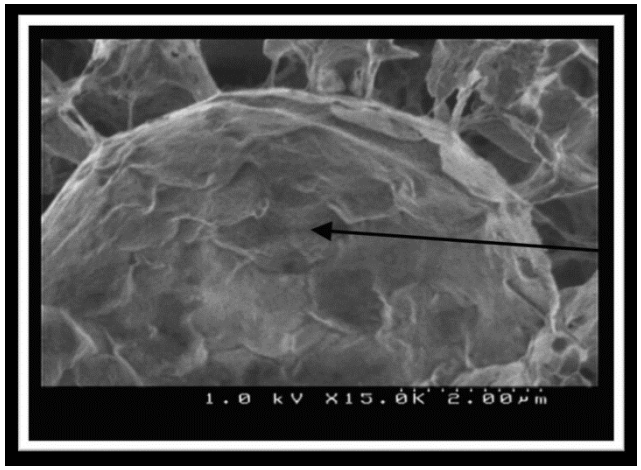
First step: the Frametime forms a layer preventing the coalescence of oil droplets. The oil phase is thus completely encapsulated into the mineral structure

Second step: the Frametime creates 3D network in the continuous phase like an honey comb structure. The network formation increases the stability of the emulsion reducing the movement of the discontinuous phase and protects

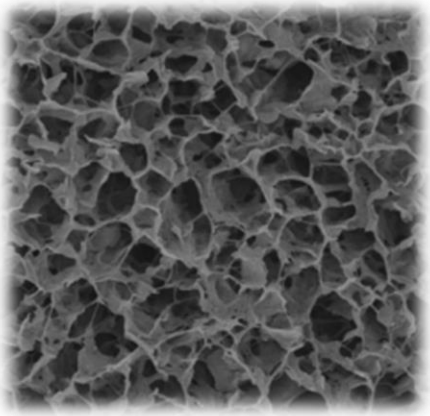


Oil droplets

Water phase



Oil droplet covered by clay particles



3D network in the Water phase

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Cold Process & « one-pot emulsion »

- Emulsification using Frametime is a very simple process.
- Frametime based emulsification method requires no additional heat sources.

Step 1: add FrameTime to the water phase and mix gently (phase A)

Step 2: add gently the oil phase to the water phase under vigorous stirring

Step 3:
discover the amazing rheological properties of this new kind of emulsion

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Cold Process, low footprint impact

Classic emulsion **Hot** Emulsification Process		**FrameTime® emulsion** **Cold** Emulsification Process
Material Cost batch 400kg	=	Material Cost Batch 400kg
Energy Consumption 40 kW/h	/100	Energy Consumption 0,4 kW/h
High Carbon Dioxide Emission		Low Carbon Dioxide Emission
Time consuming (2h)	/8	Fast Process (15min)

Cost and environmental Impact

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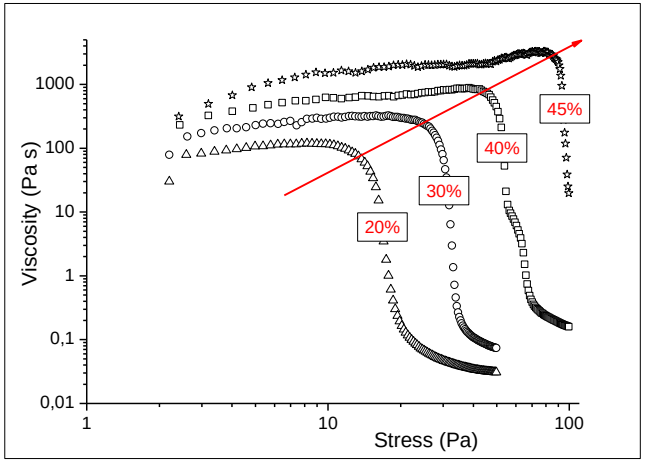
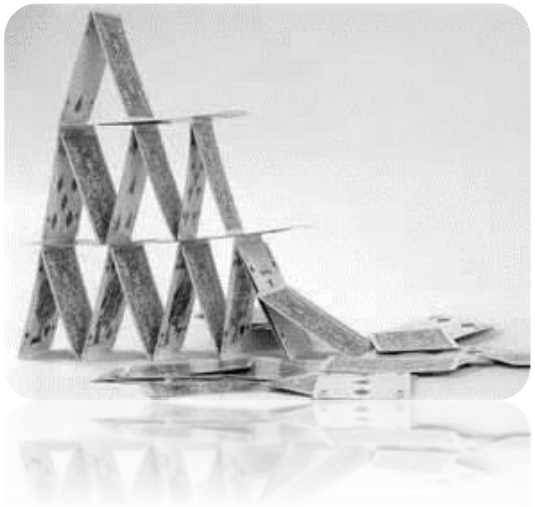
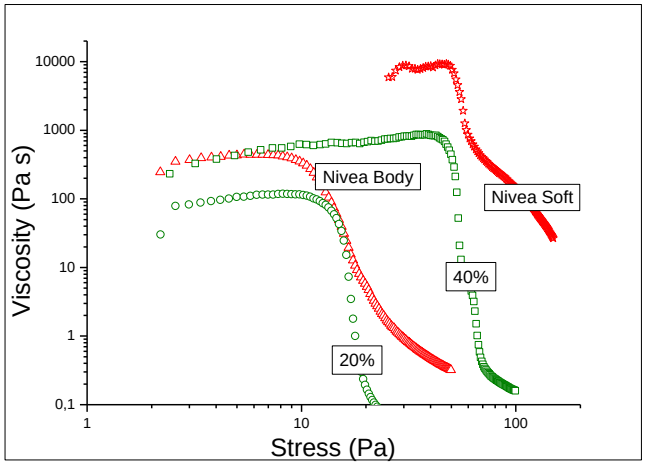
Stability : yield point

- Structured fluids like pickering emulsion often will not flow unless they have reached a critical stress level called the yield stress, below which the emulsion is "fully" elastic and above which the structure of the emulsion breaks and it flows.



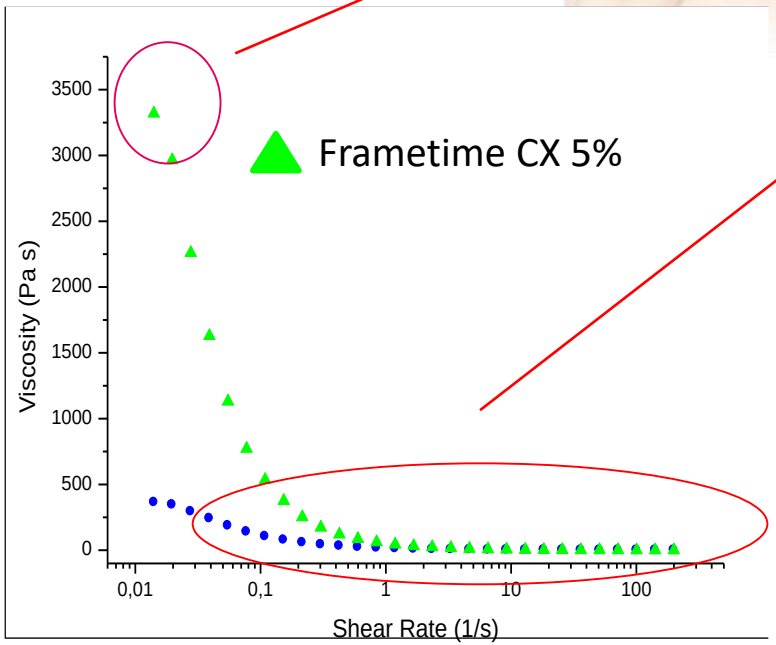
Increasing Oil amount effect





Stability : shear thinning behavior

- A high viscosity is desirable when removing a cream from the jar and at the start of application



- **Primary skin feel** is the sensation occurring when an emulsion is initially applied to the skin. This is associated with small forces needed to make the emulsion flow.

- Pumpability: packaging optimization
- Preservative reduction

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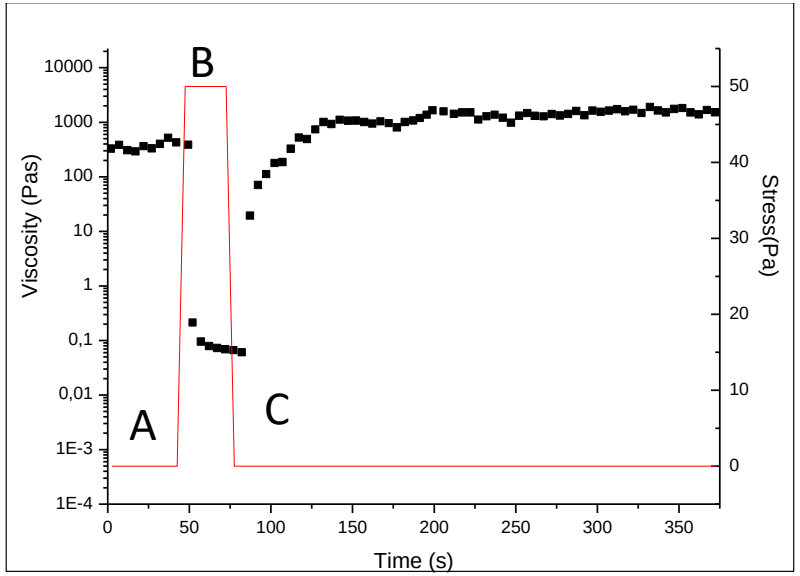
Stability : structure Breakdown and Build Up

- Most cosmetic emulsions are deformed when a small amount is removed. How quickly the structure is restored can be crucial



- A: At rest
- B: The amplitude is suddenly increased (100-fold over the LVR): structure breakdown
- C: The amplitude is returned into the LVR: structure build-up

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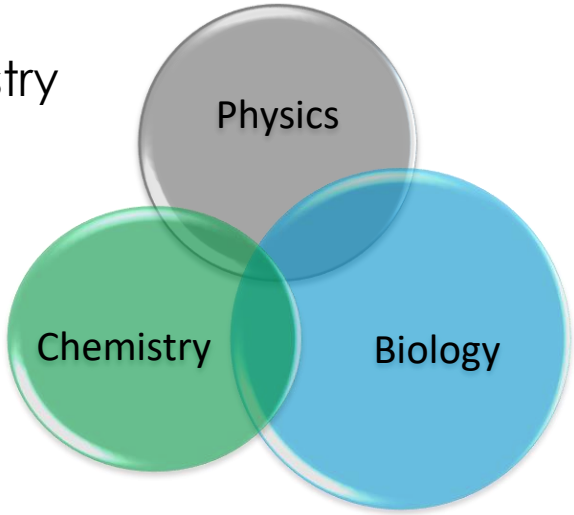
Multi properties materials for multi-purpose applications

- Highly effective combination of physic, chemistry and biology



- Short term effect thanks to the mineral structure: “make-up effect”
- Middle-long term effect thanks to the protection and drug delivery of biomolecules

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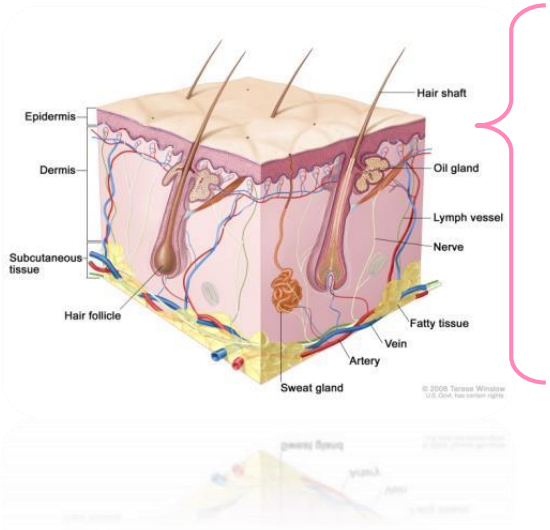
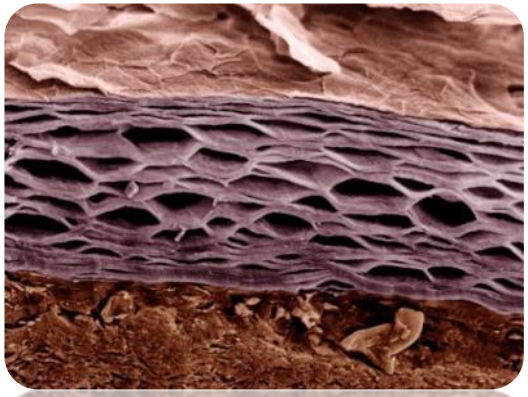
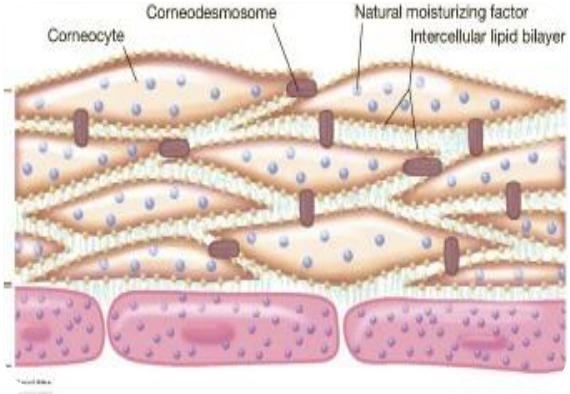
The second Skin, a mimetic approach

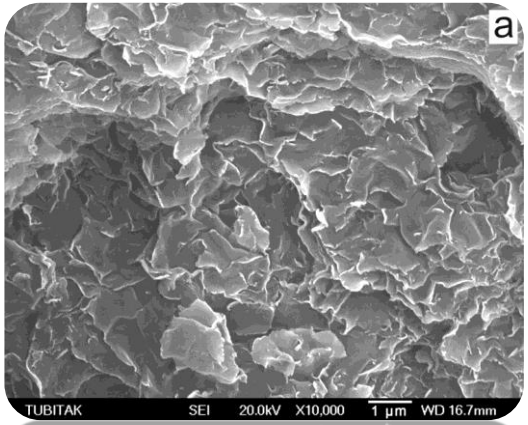


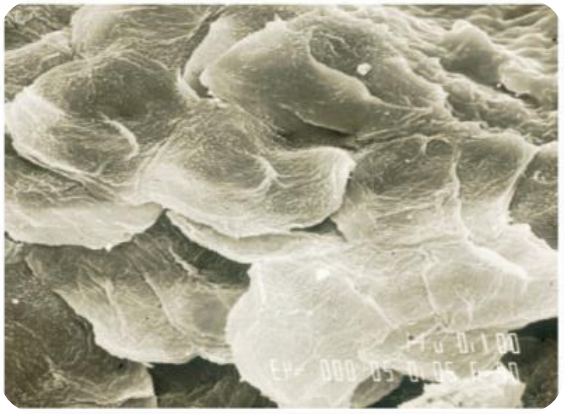


Photographic Print by Veronika Burmeister



- Protection, barrier
- Storage
- Thermal regulation
- Control of evaporation
- Aesthetics and communication





Corneocyte clumpiness collected on a CSSS

Second skin, the short term effect

Before Frametime application

- Short term effect thanks to the mineral structure, Aesthetics purposes:
  - Reducing Micro roughness including folds and wrinkles
  - Soft skin to the touch
  - Softener and lifting effect

After Frametime application

- Short term effect thanks to the mineral structure, protection purposes
  - Penetration of the exogenous potentially dangerous substances
  - UV radiation: SPF booster
  - Loss of endogenous water

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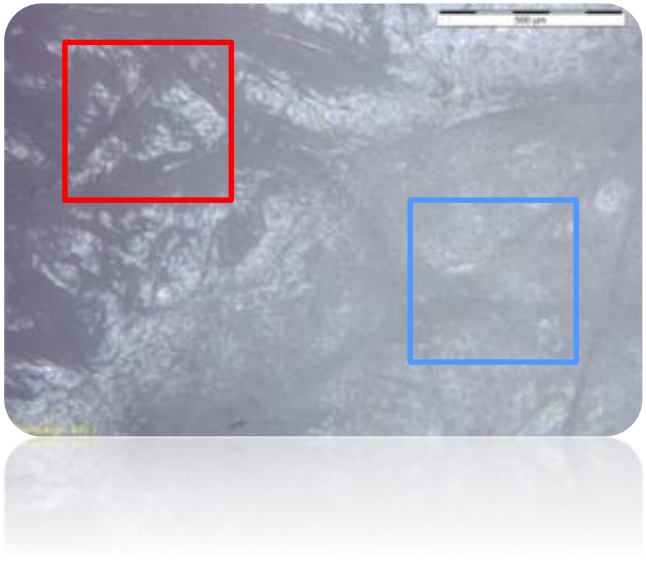
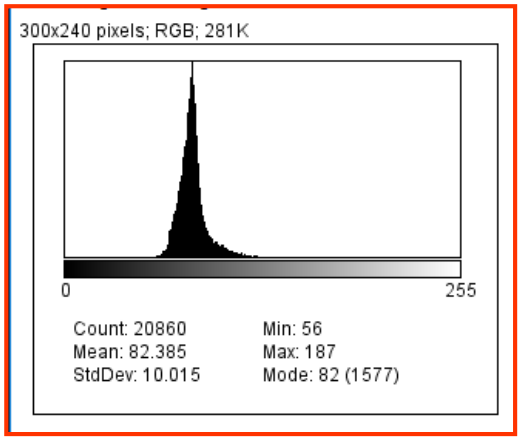
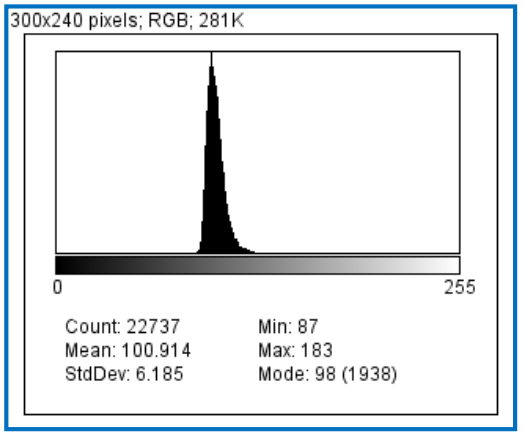
Second skin, the short term effect

- Short term effect thanks to the mineral structure:
  - Soft Focus effect blurs away imperfections







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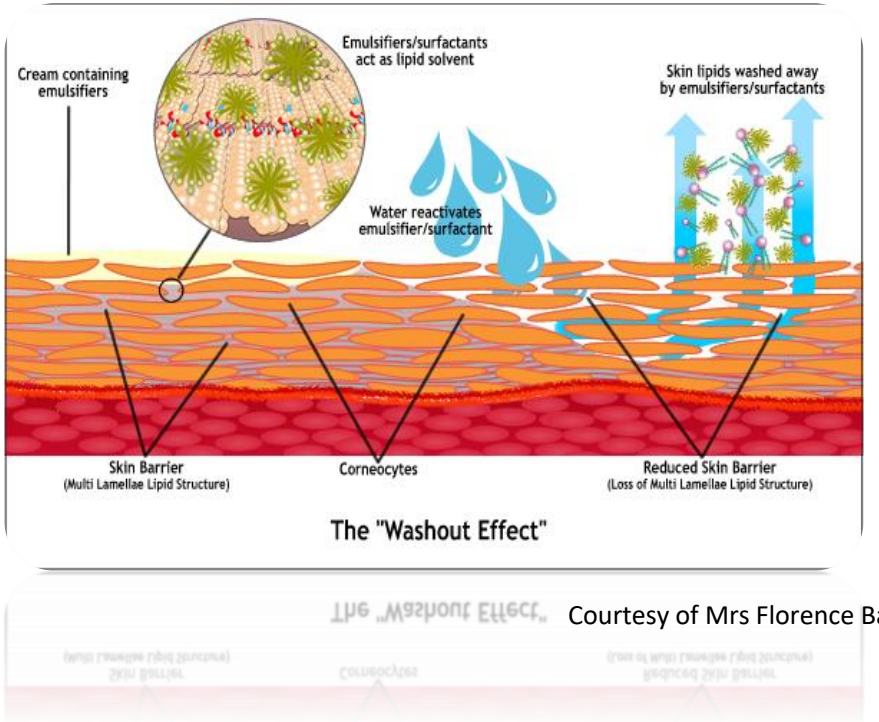
Hydration and Transepidermal Water Loss

- Emulsifiers do not lose their emulsifying properties once on the skin
- The most important components of the corneocytes contributing towards intercellular cohesion are the multilamellar lipids. The lamellar lipid phase being primarily responsible for slowing transepidermal water loss. The skin will exhibit changes in appearance when there is deterioration in these important skin barrier defense systems.
- Conventional creams are not tolerated by consumers with barrier disorder skin problems



Courtesy of Mrs Florence Barrett-Hill

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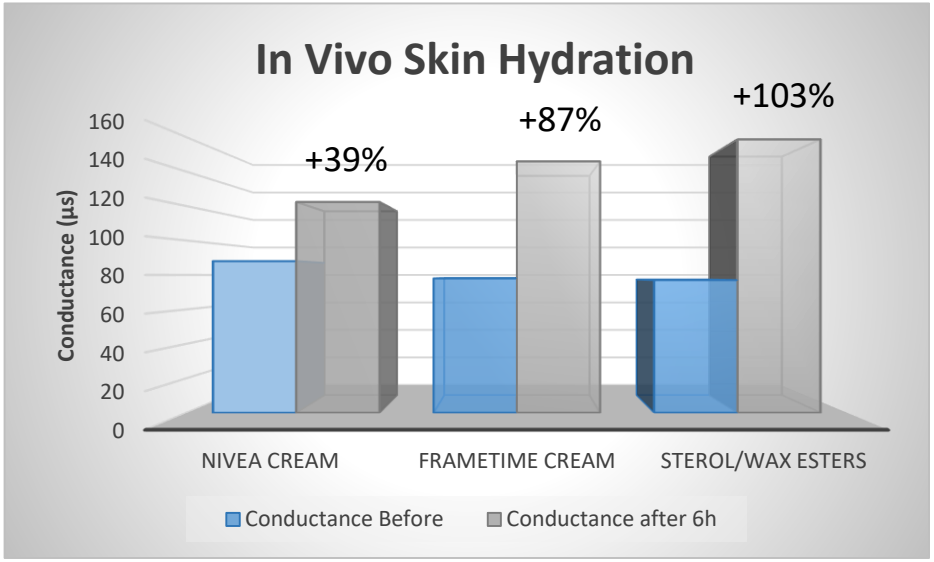
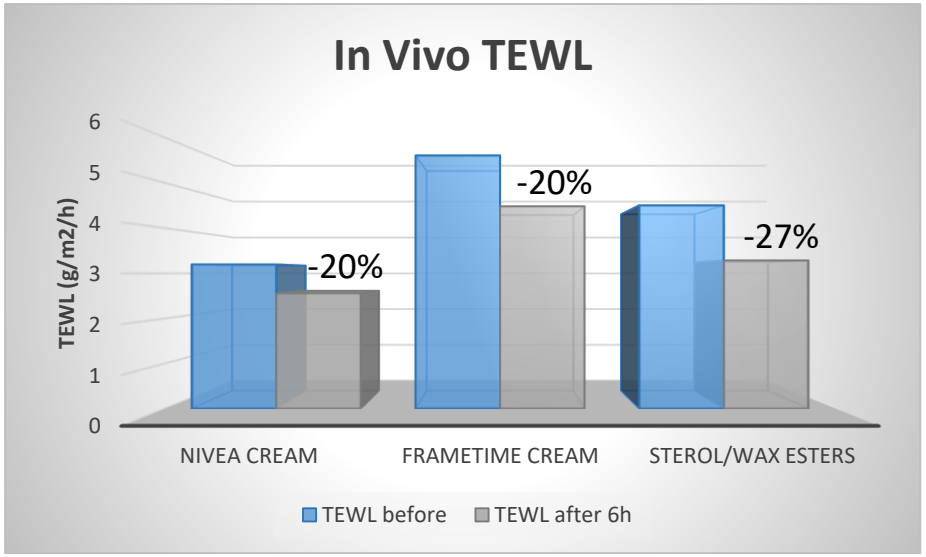
Hydration and Transepidermal Water Loss

- In Vivo study





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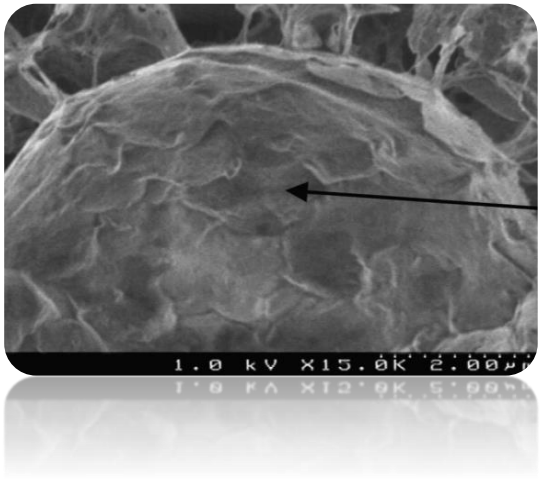
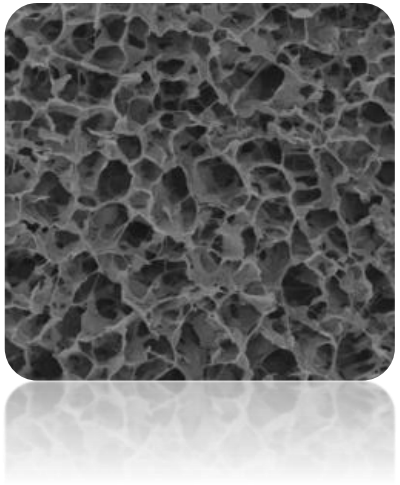
Middle-long term effect: Oil & Water phase Protection

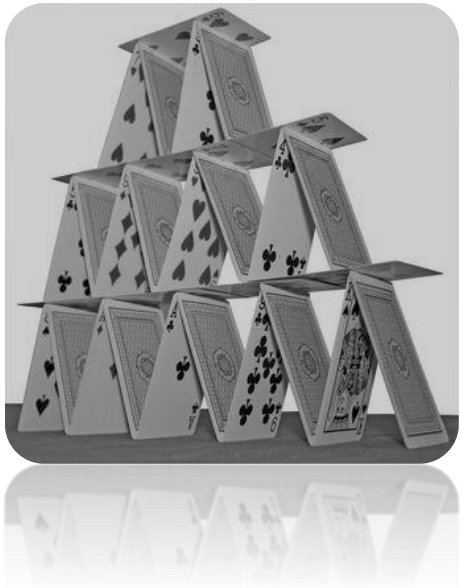


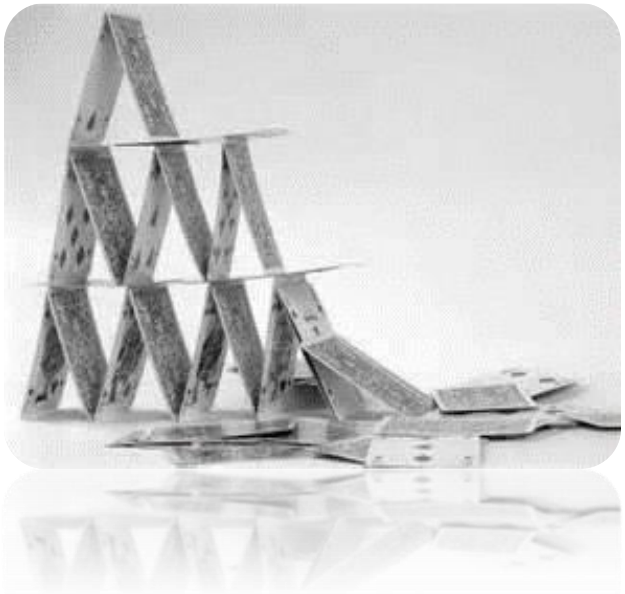


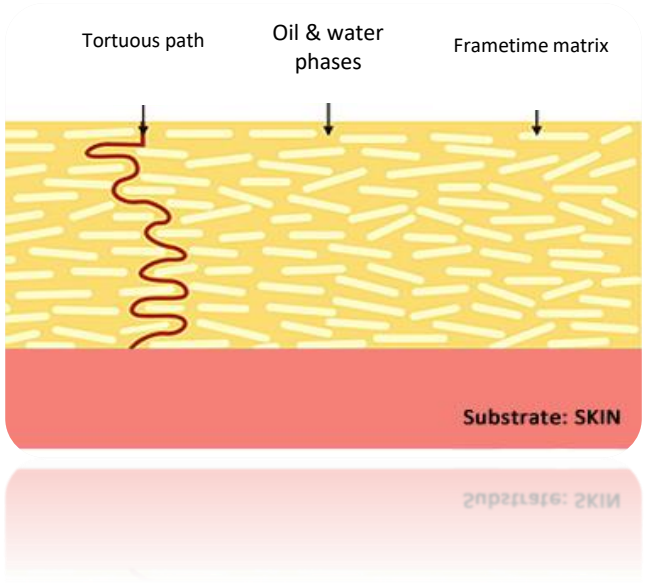
Once dispersed into the finish product:

- Oil phase encapsulation
- 3D network formation like “honey-comb” structure in the water phase

New Drug delivery strategy, prolonged release







Once on the skin:

Creation of the mineral structure like a second skin ables to delivered in a controlled manner the oil & water phases thanks to the creation of a labyrinth path .

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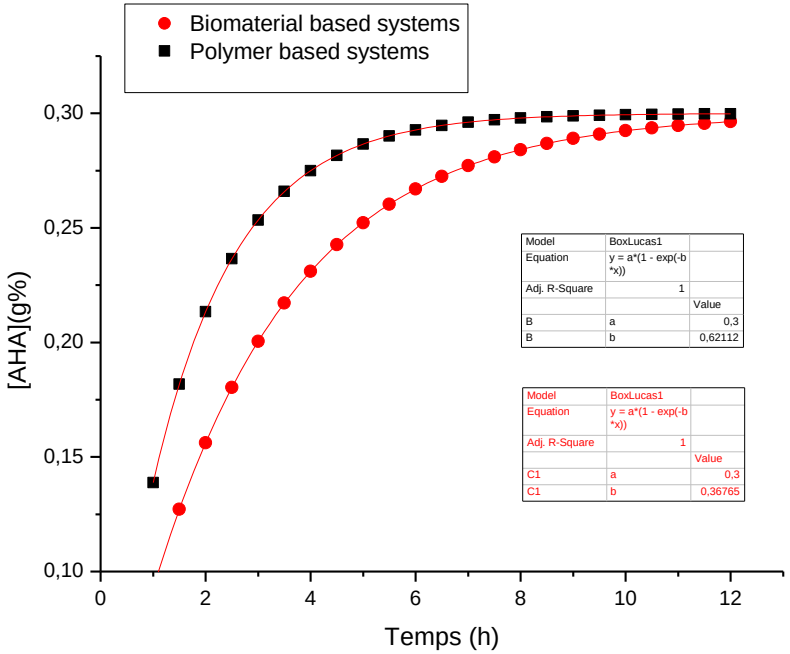
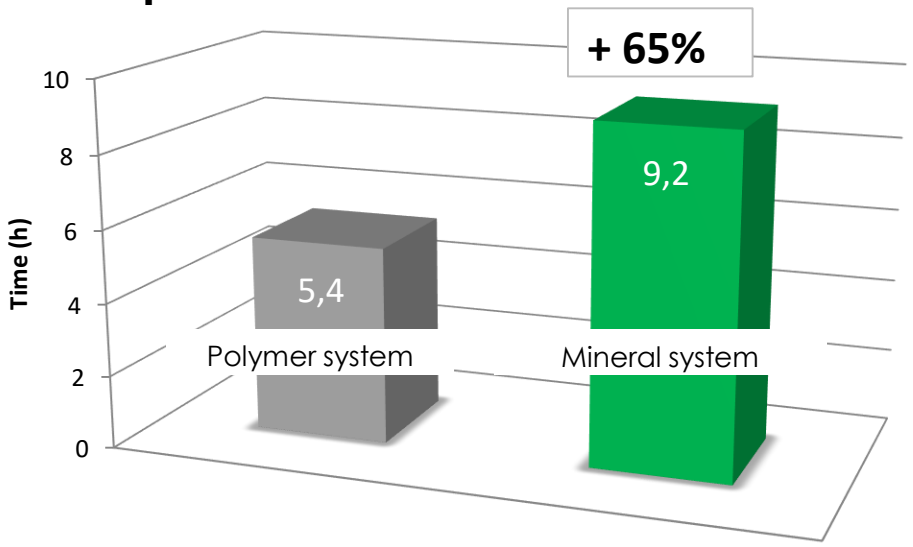
New Drug delivery strategy, prolonged release

- Paracelsus said "Poison is in everything, and no thing is without poison. The dosage makes it either a poison or a remedy.
  - E.g. After 24 h of occlusive water exposure, cytotoxic injury to the viable epidermis occurs, accompanied by inflammatory changes.



Kinetic Equilibrium



Slow release for a better effect

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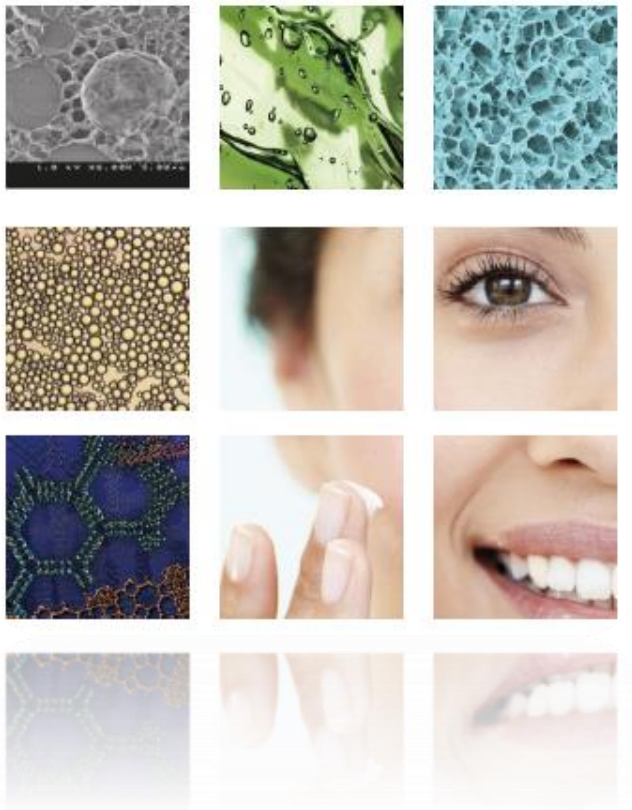

Do not hesitate to contact me fabrizio@ephyla3.com