

Filled chocolates/pralines

Migration fat bloom

10/09/2012

Ir. Claudia Delbaere



Praline production



Chocolate

Most prone to fat bloom:

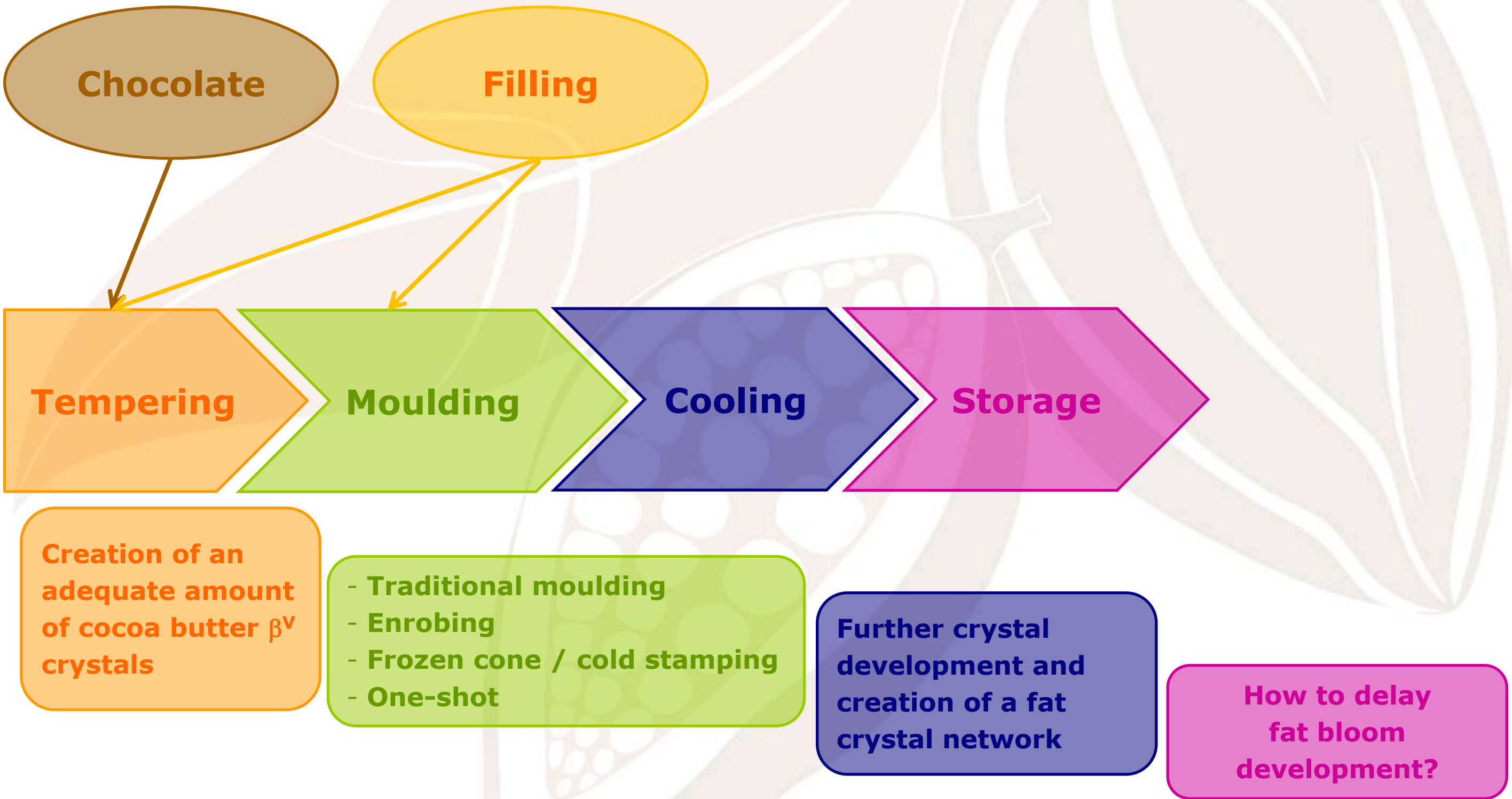
- Dark chocolate
- Milk chocolate

Filling

Most prone to fat bloom:

- Nut based fillings (e.g. hazelnut based fillings)
- Fat based fillings





Traditional moulding

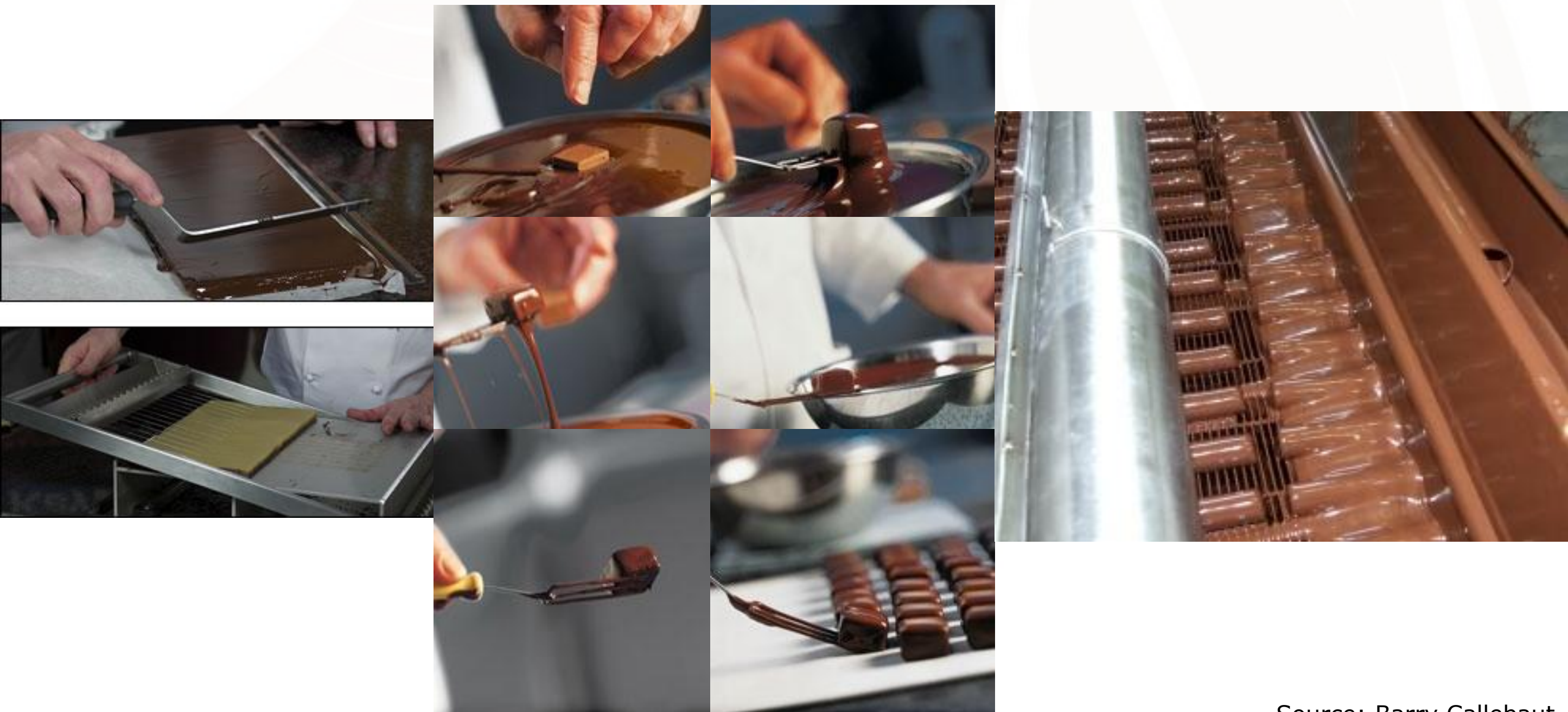
Mould preheating – chocolate shell – vibration – cooling – filling – cooling – chocolate base – cooling - demoulding



Source: Barry
Callebaut

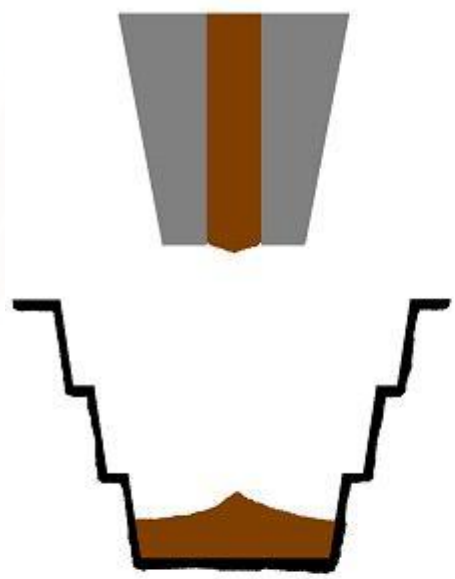
Enrobing

Filling preparation – cooling – enrobing with chocolate

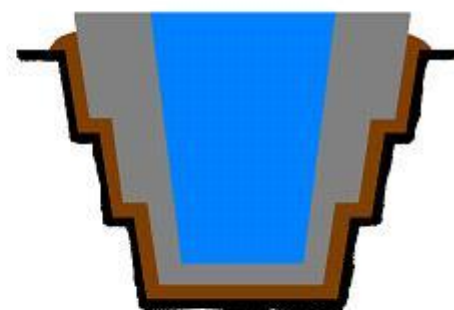


Source: Barry Callebaut

Cold stamping (frozen cone)



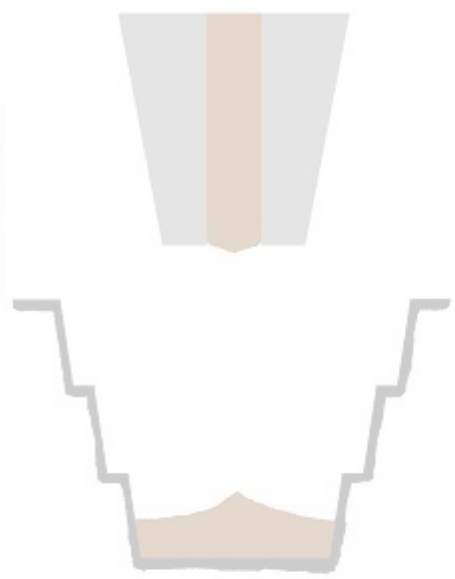
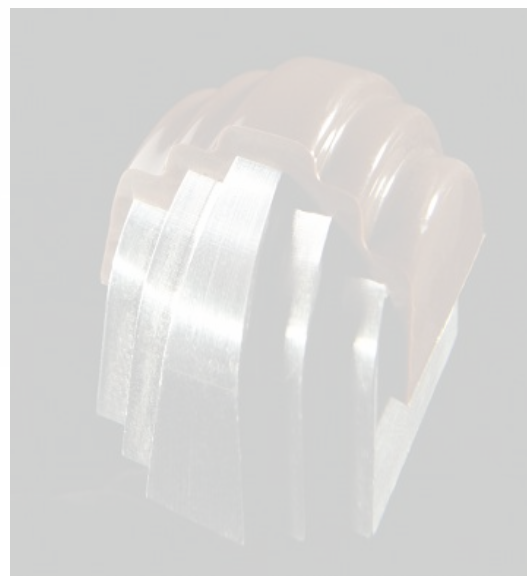
Depositing



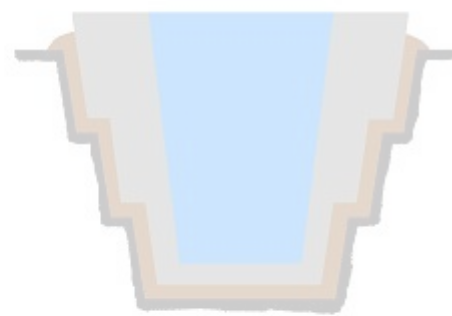
Cold shell forming

Source: Bühler

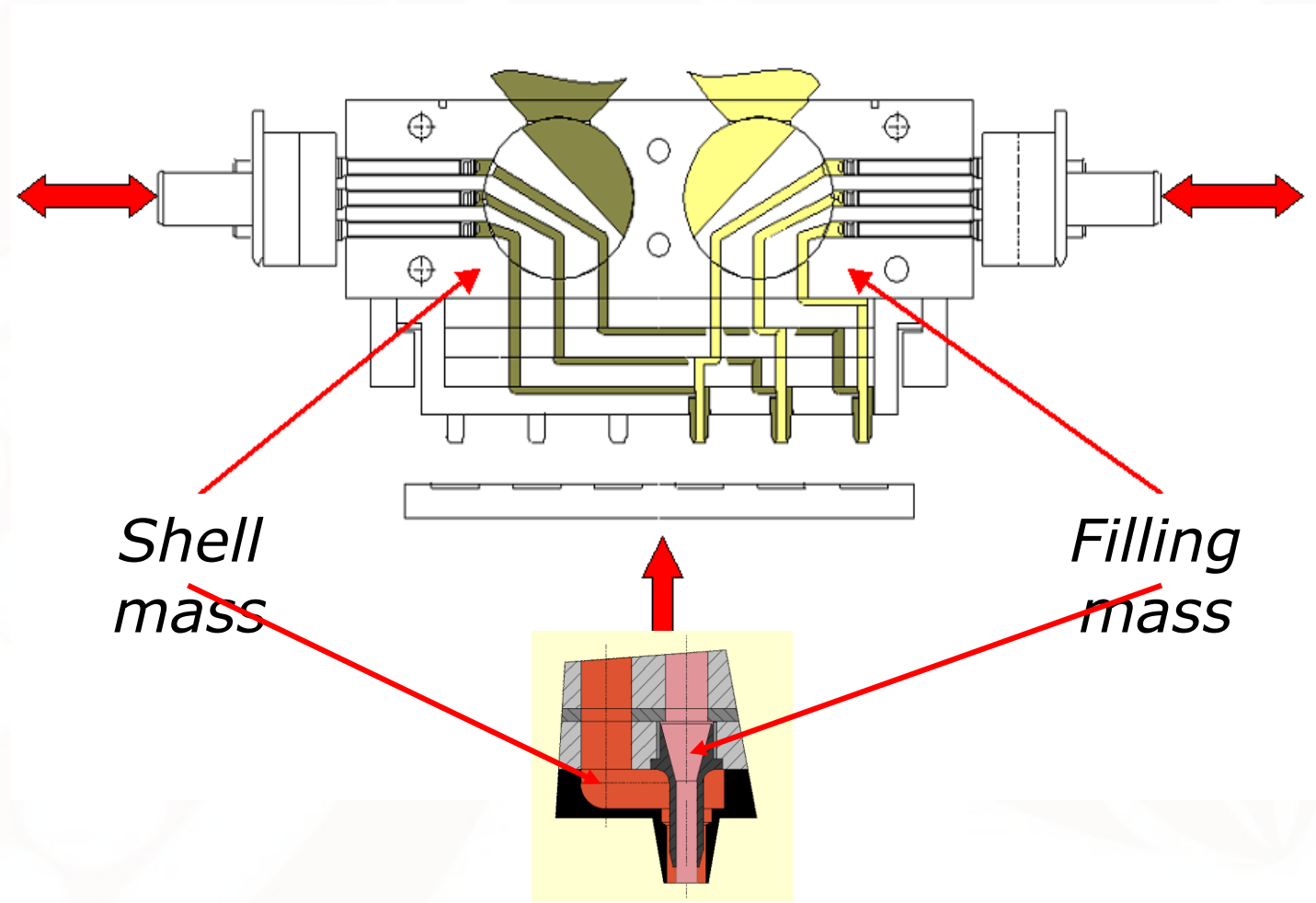
One-shot



Depositing



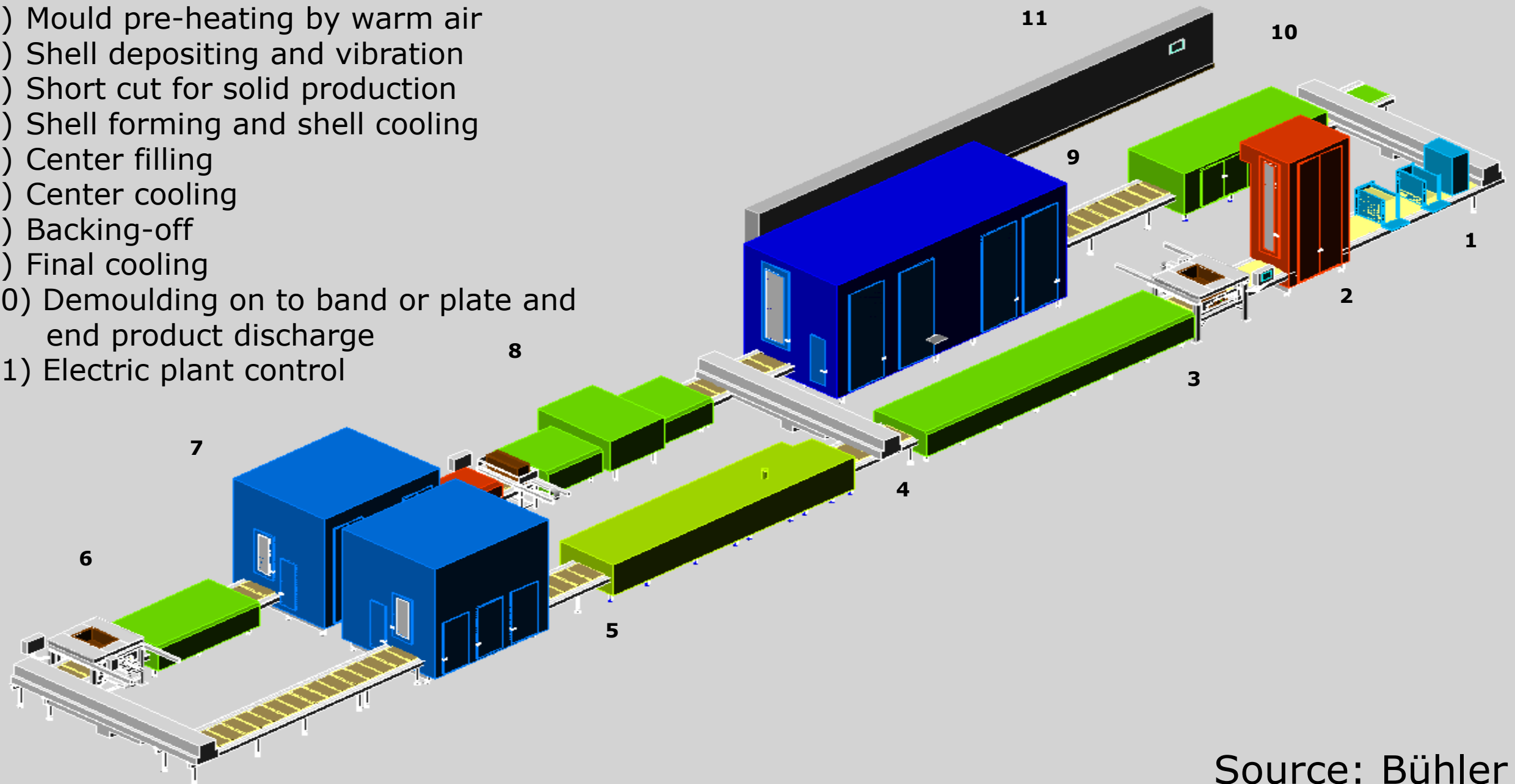
Cold shell forming



Source: Bühler

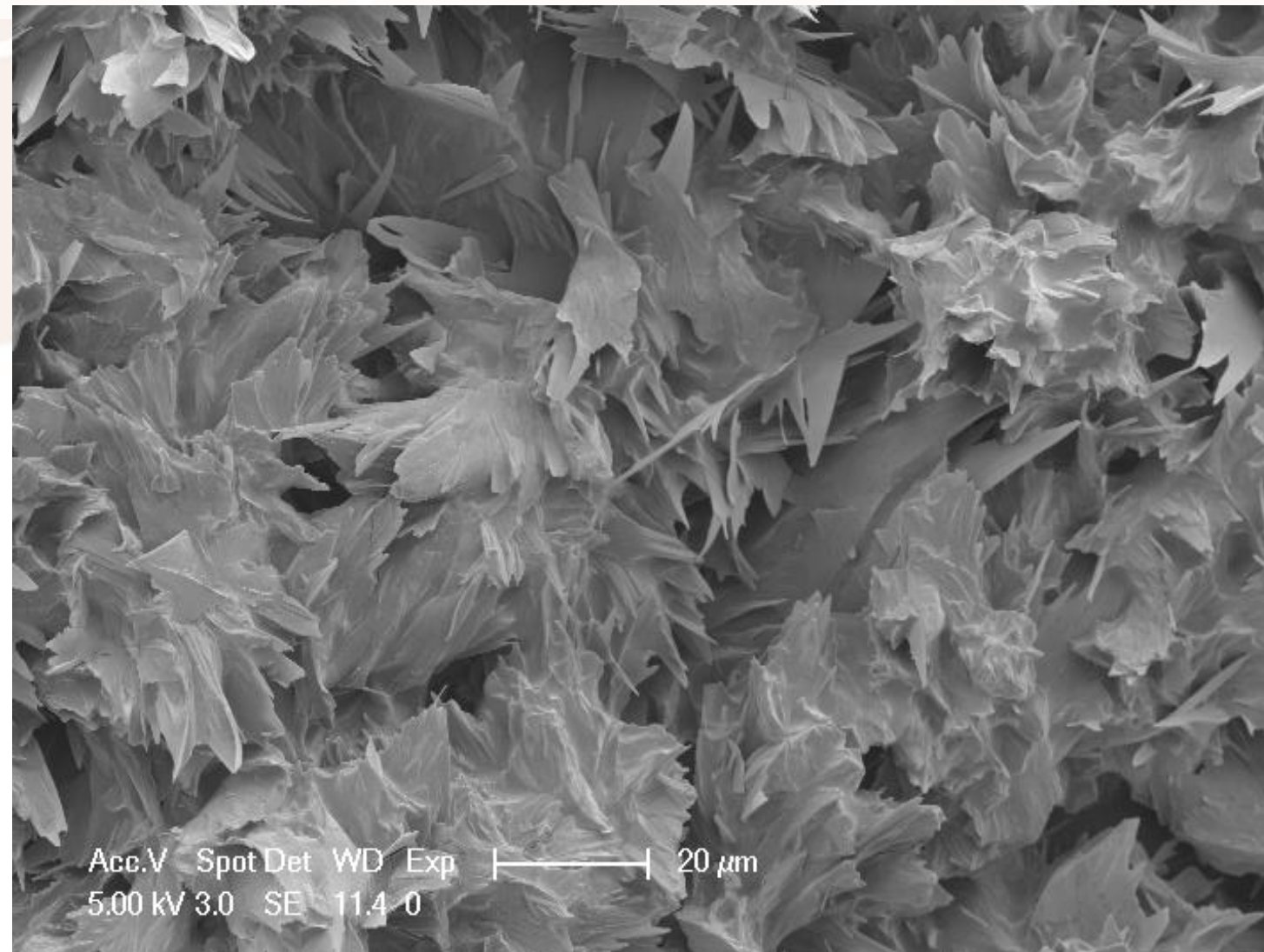
Example of an industrial production line

- 1) Mould checking and (automatic) changing section
- 2) Mould pre-heating by warm air
- 3) Shell depositing and vibration
- 4) Short cut for solid production
- 5) Shell forming and shell cooling
- 6) Center filling
- 7) Center cooling
- 8) Backing-off
- 9) Final cooling
- 10) Demoulding on to band or plate and end product discharge
- 11) Electric plant control



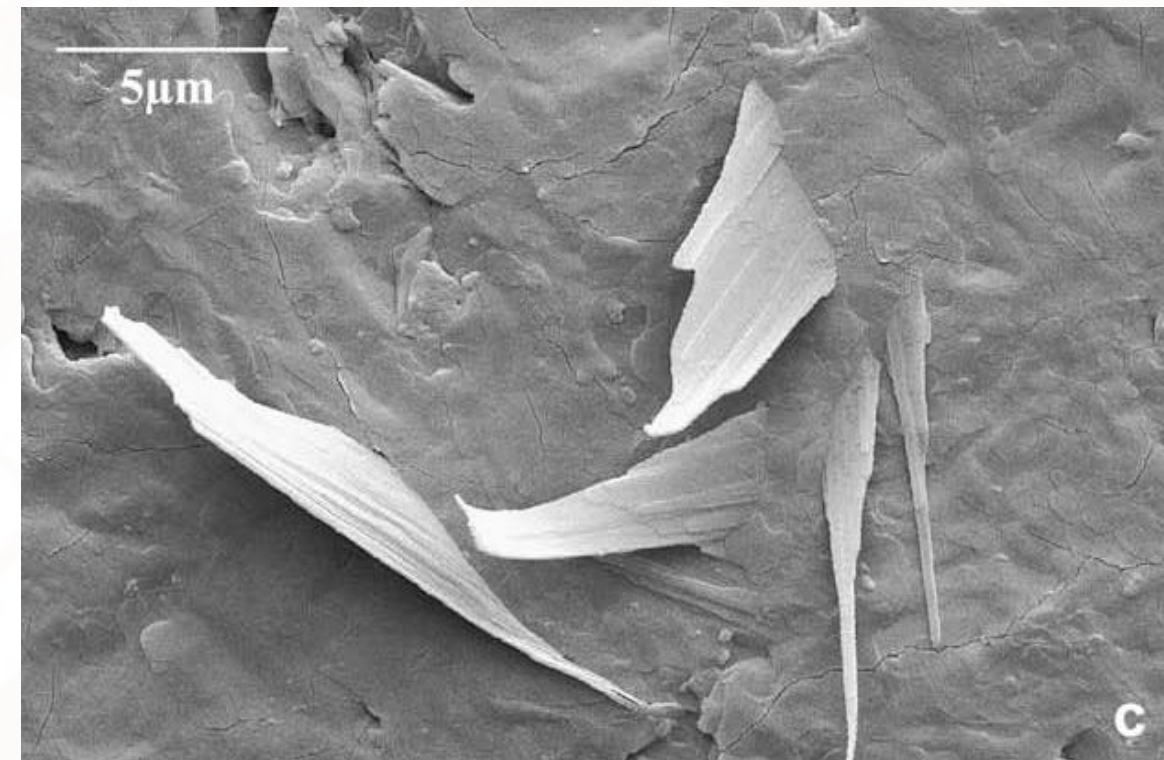
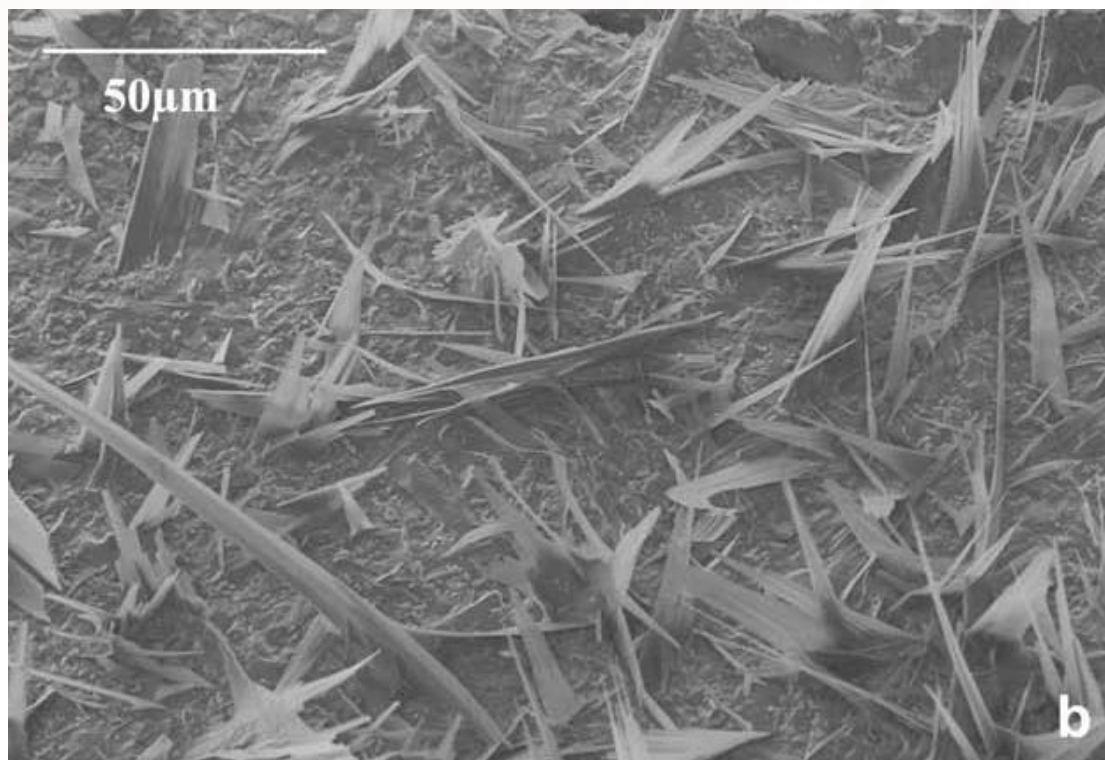
Source: Bühler

Migration fat bloom



Fat bloom

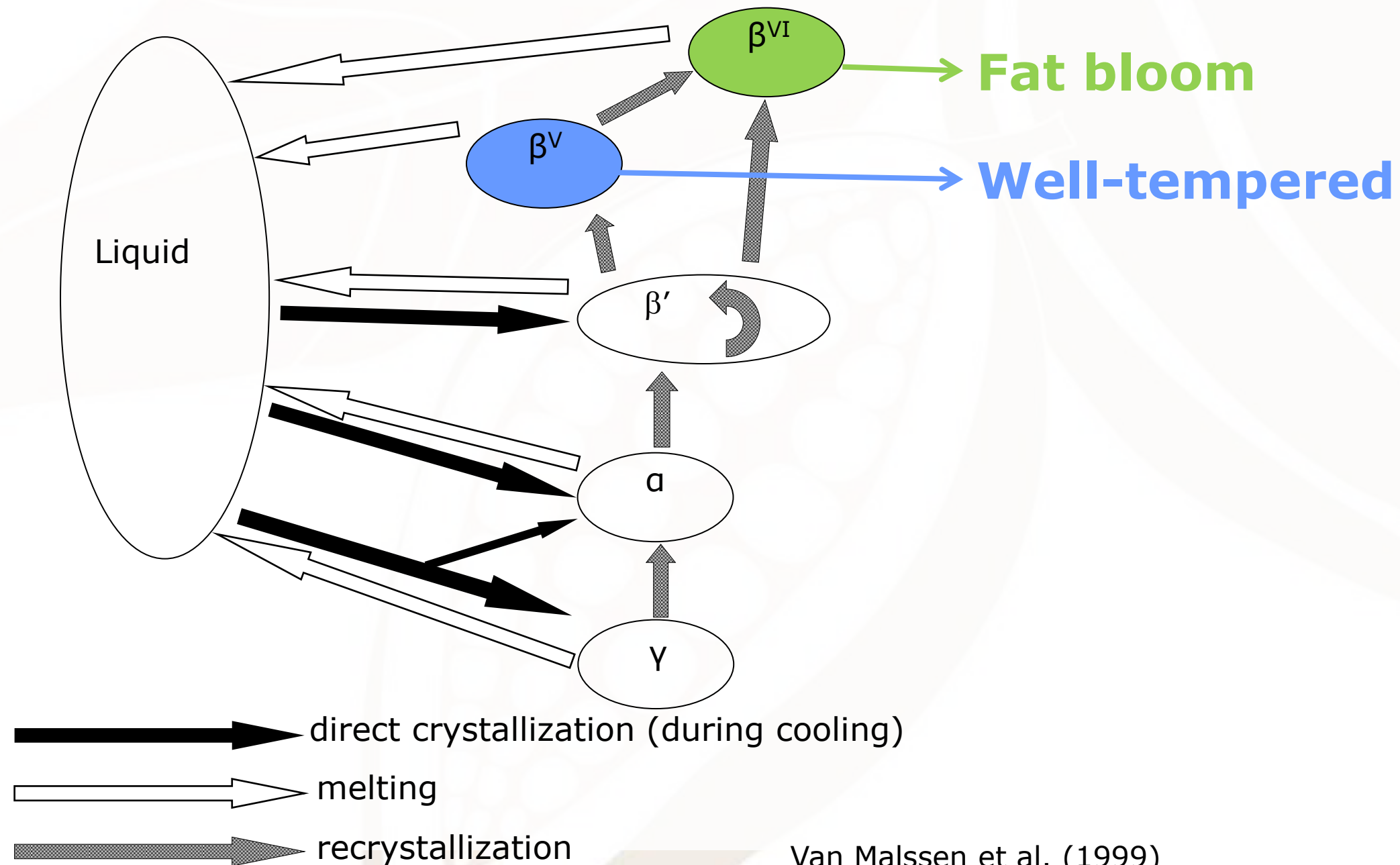
- Loss of initial gloss
- Formation of white-greyish haze
- Fat crystals on the surface → Diffraction of light



James and Smith (2009)

Polymorphic fat bloom

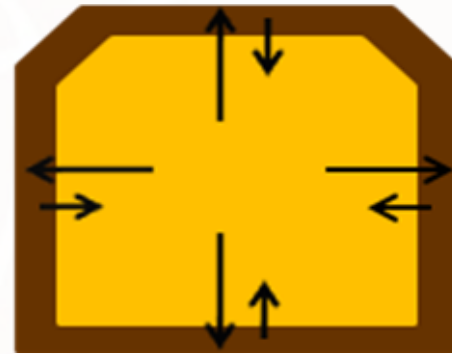
- Plain chocolate: cocoa butter crystal **polymorphism** ($\beta^V \rightarrow \beta^{VI}$)



Van Malsen et al. (1999)

Migration fat bloom

- Composed chocolate products: **migration** of liquid foreign lipids (e.g. from the filling, nut, biscuit) into the chocolate



- Fat bloom = quality problem n° 1 in filled chocolate industry
 - Shelf life reduction
 - Hampering export
 - Consumer rejection
- Less research compared to plain chocolate bloom
 - In contrast with current higher industrial relevance !

• European chocolate manufacturing market:

> 2.000 companies

> 200.000 people

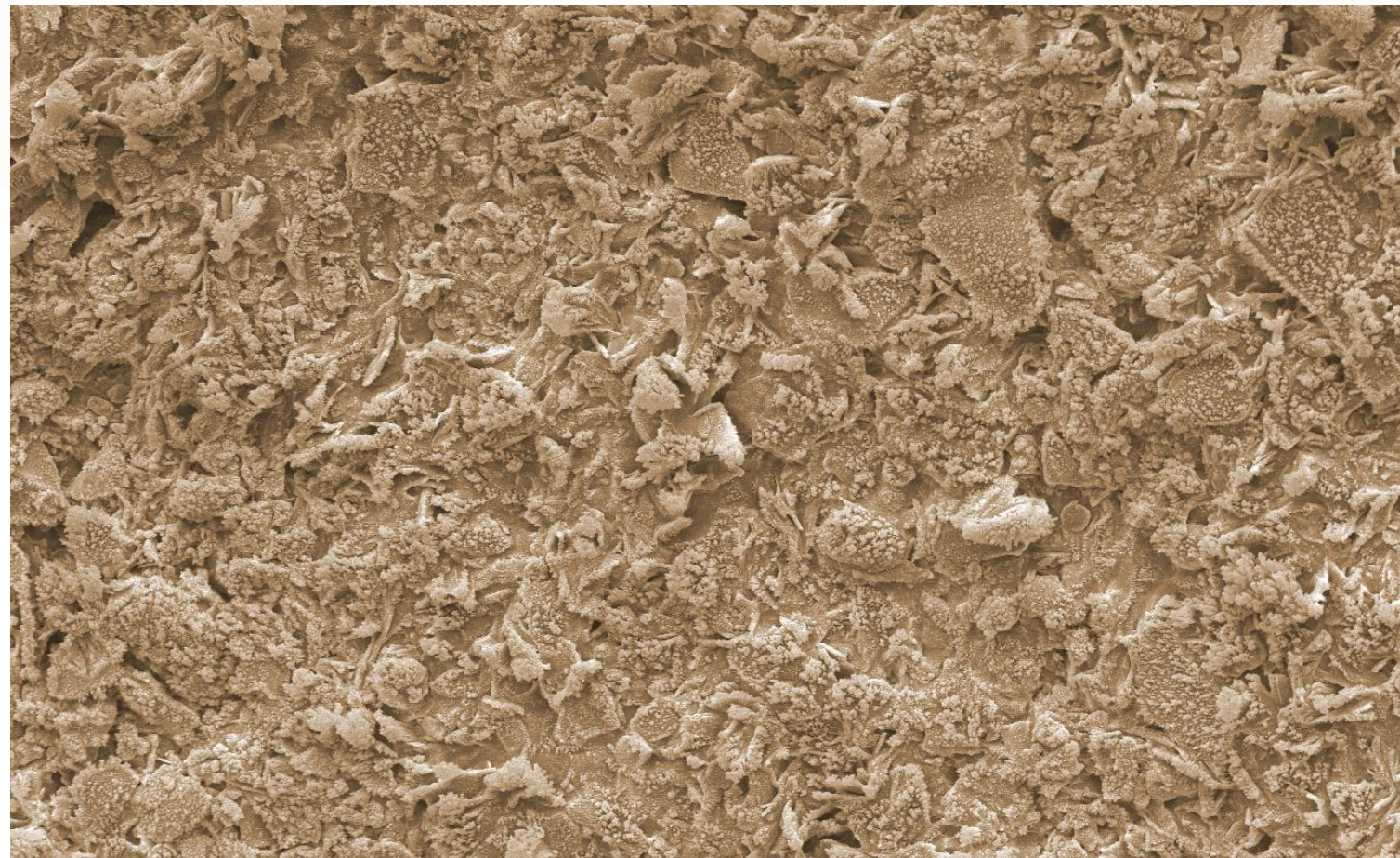
> 43 billion Euro annual turnover

> 3 billion Euro export

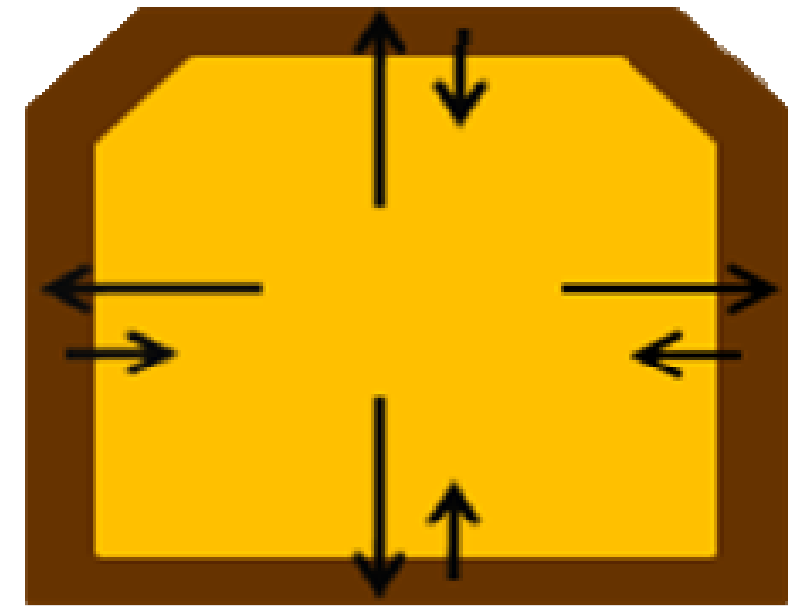
• Large proportion of SMEs (> 90%)

≠ **Sugar bloom**

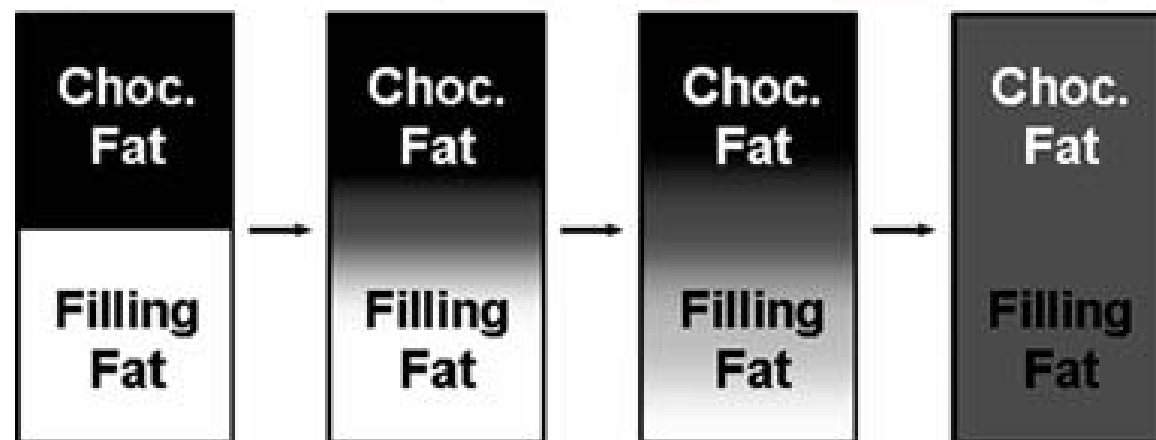
- Caused by condensation (colder → warmer)
- Solubilization and recrystallization of sugar @ chocolate surface
- Storage in frigde



- Chocolate products with fat-based fillings, nuts, ...



- Driving force: $\Delta(\text{TAG})$



Smith et al. 2007

■ Mechanisms:

- Diffusion
- Capillary forces

■ Crucial role of chocolate microstructure!

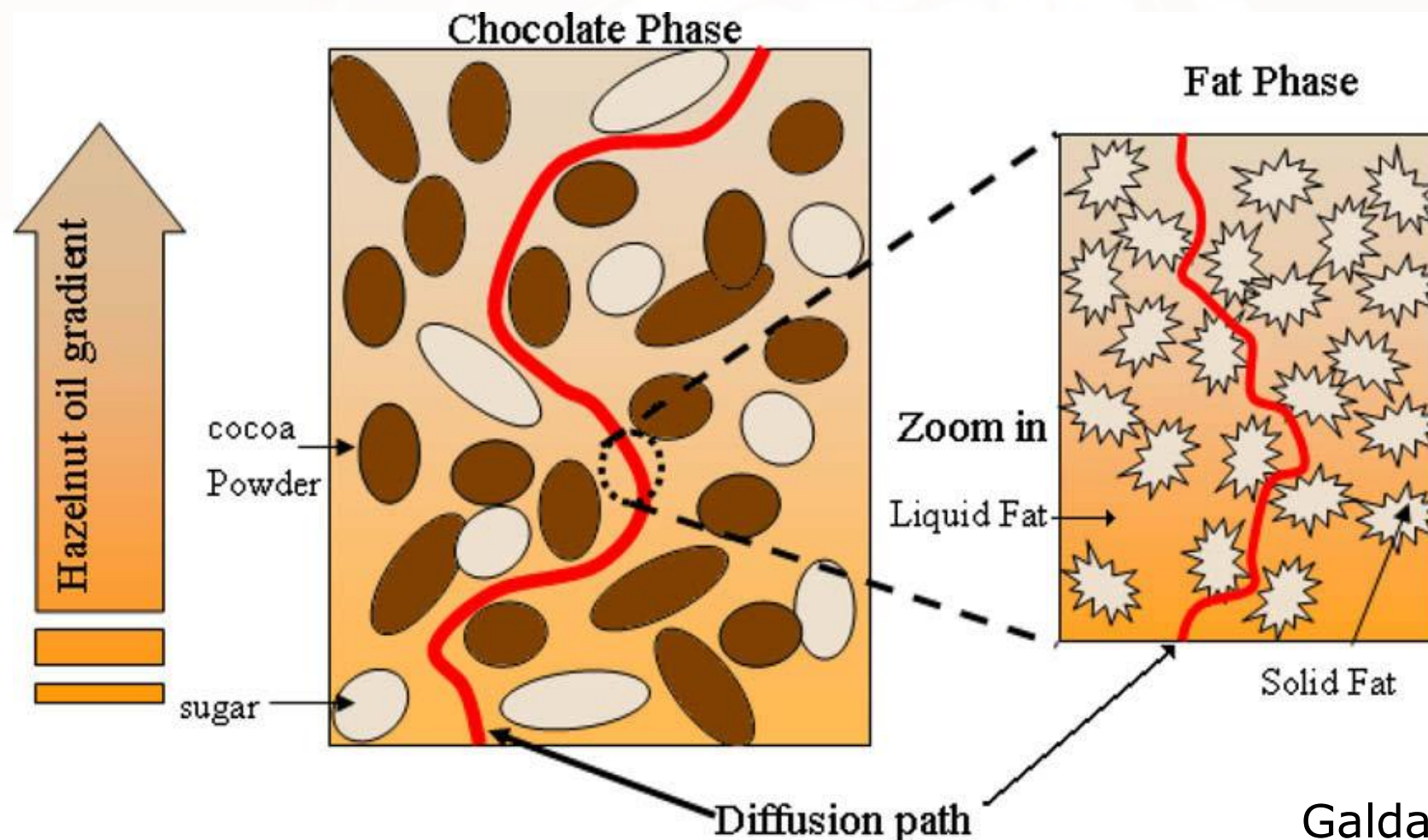
$$D_{\text{eff}} = D \varepsilon / \tau$$

D = diffusivity

ε = void fraction

τ = tortuosity

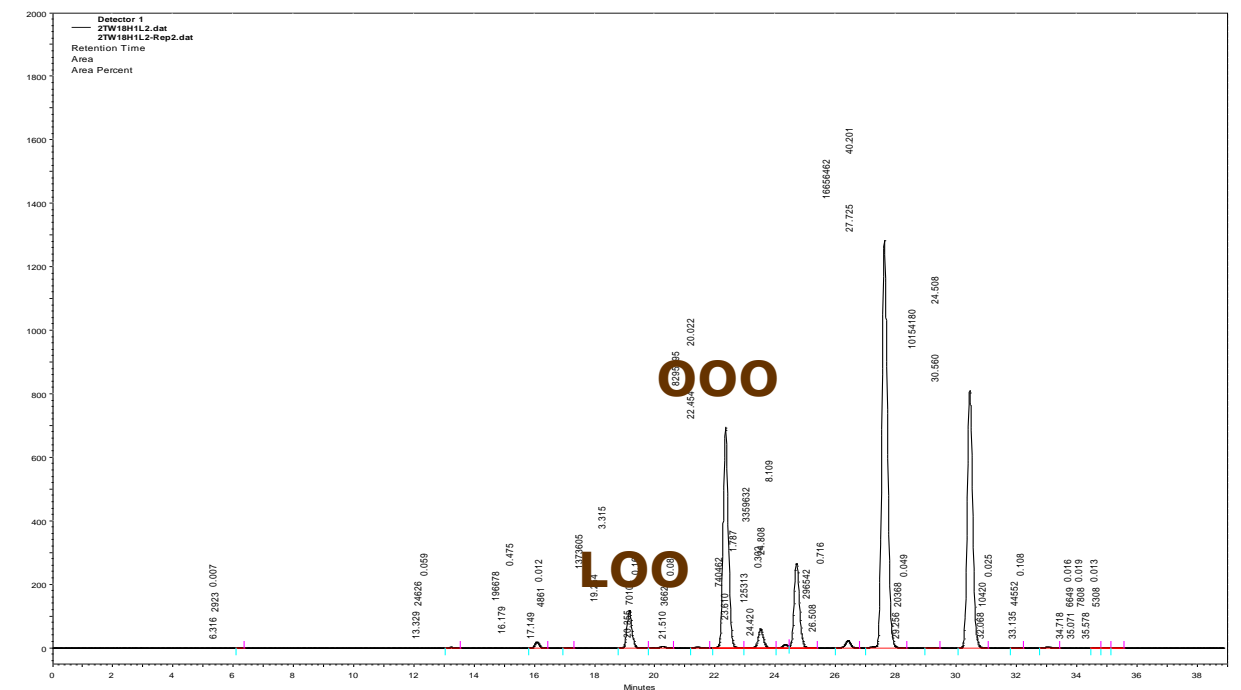
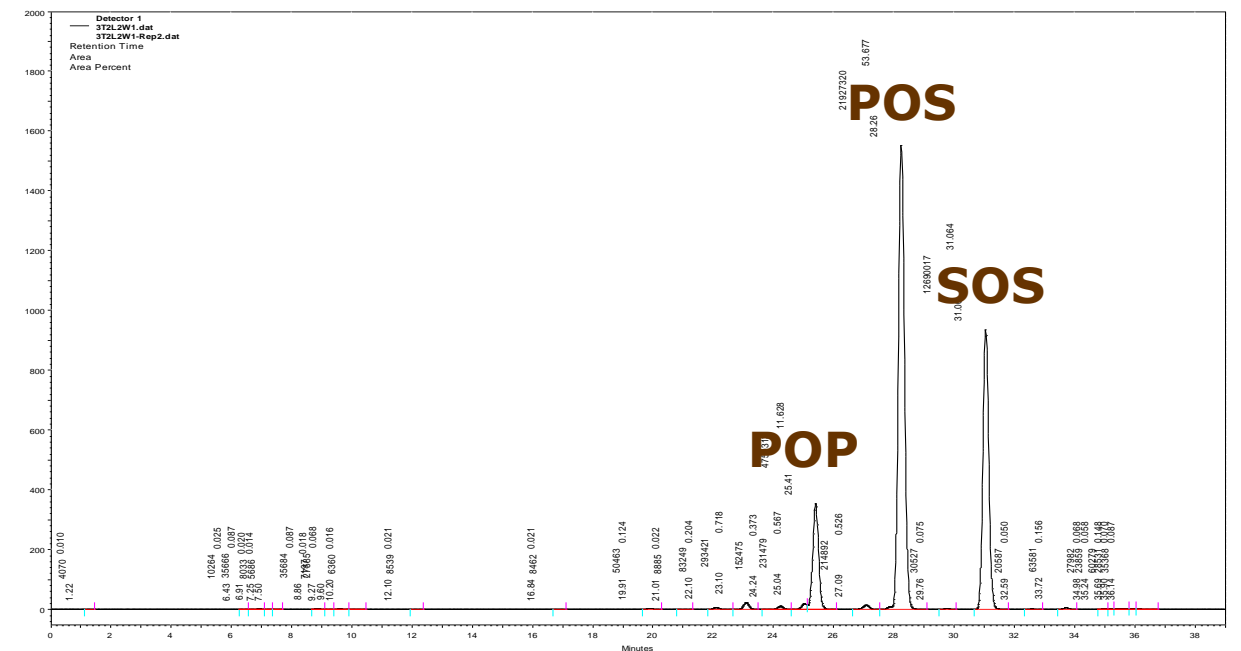
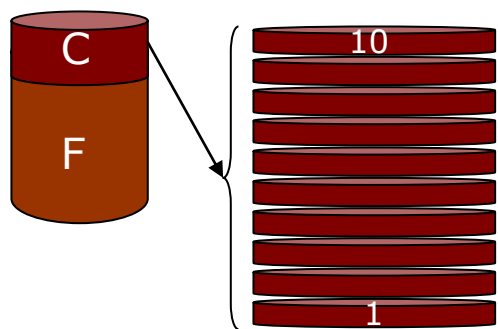
→ $D_{\text{eff}} \sim \text{structure}$



Galdamez et al. 2009

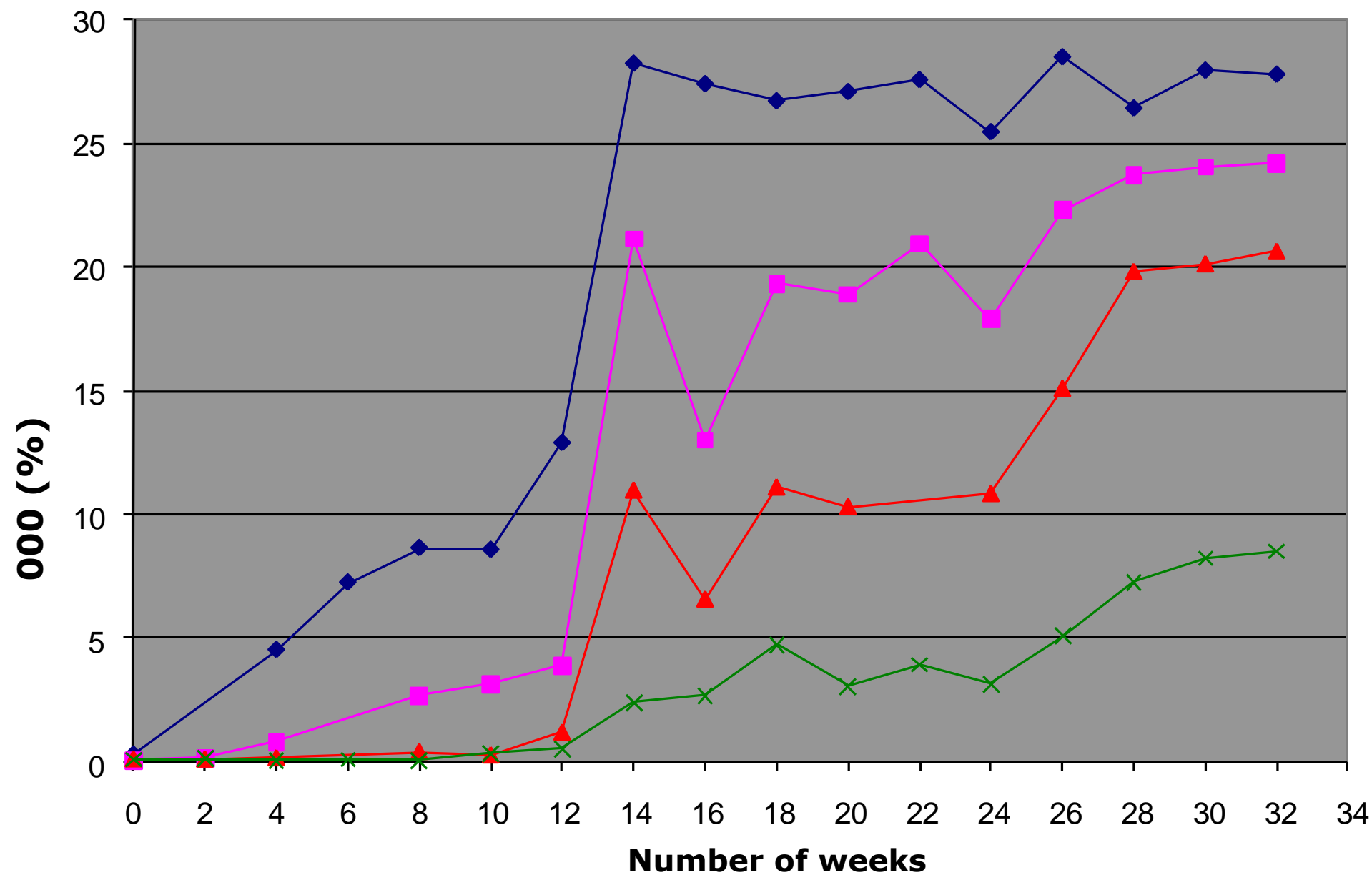
Methods to study oil migration: example

- TAG composition → HPLC-analysis

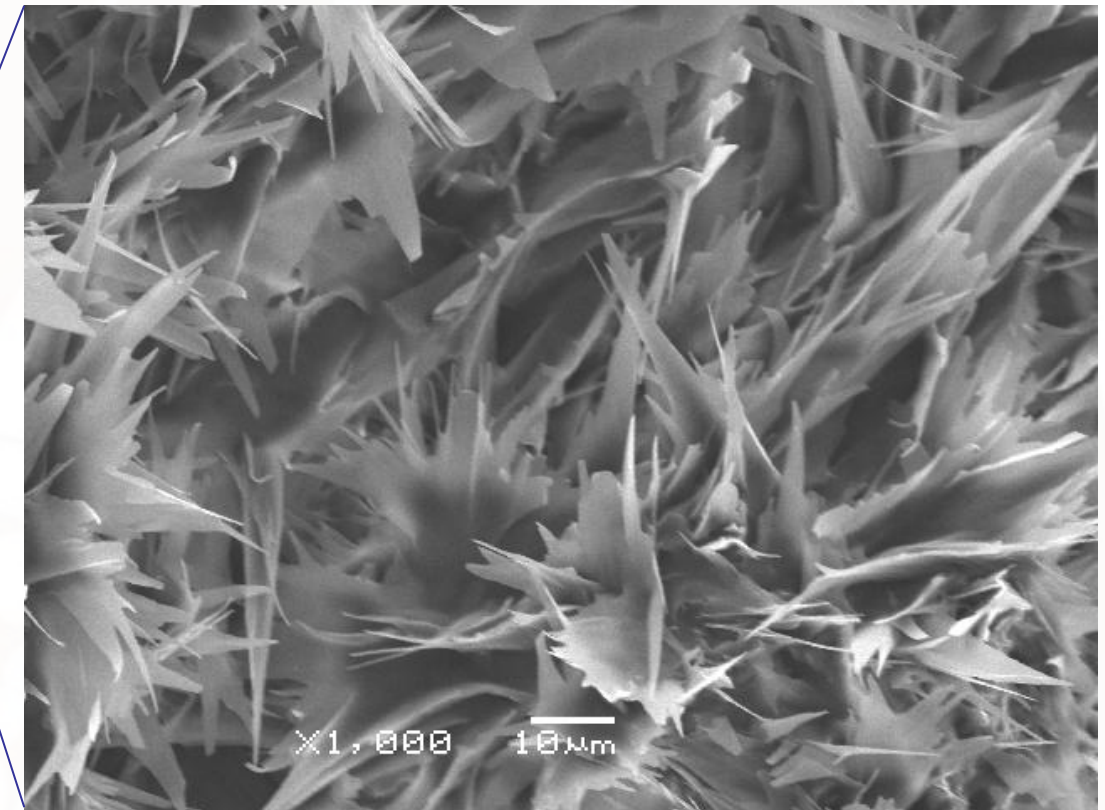
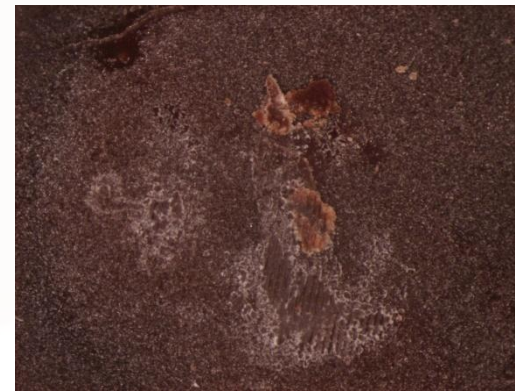
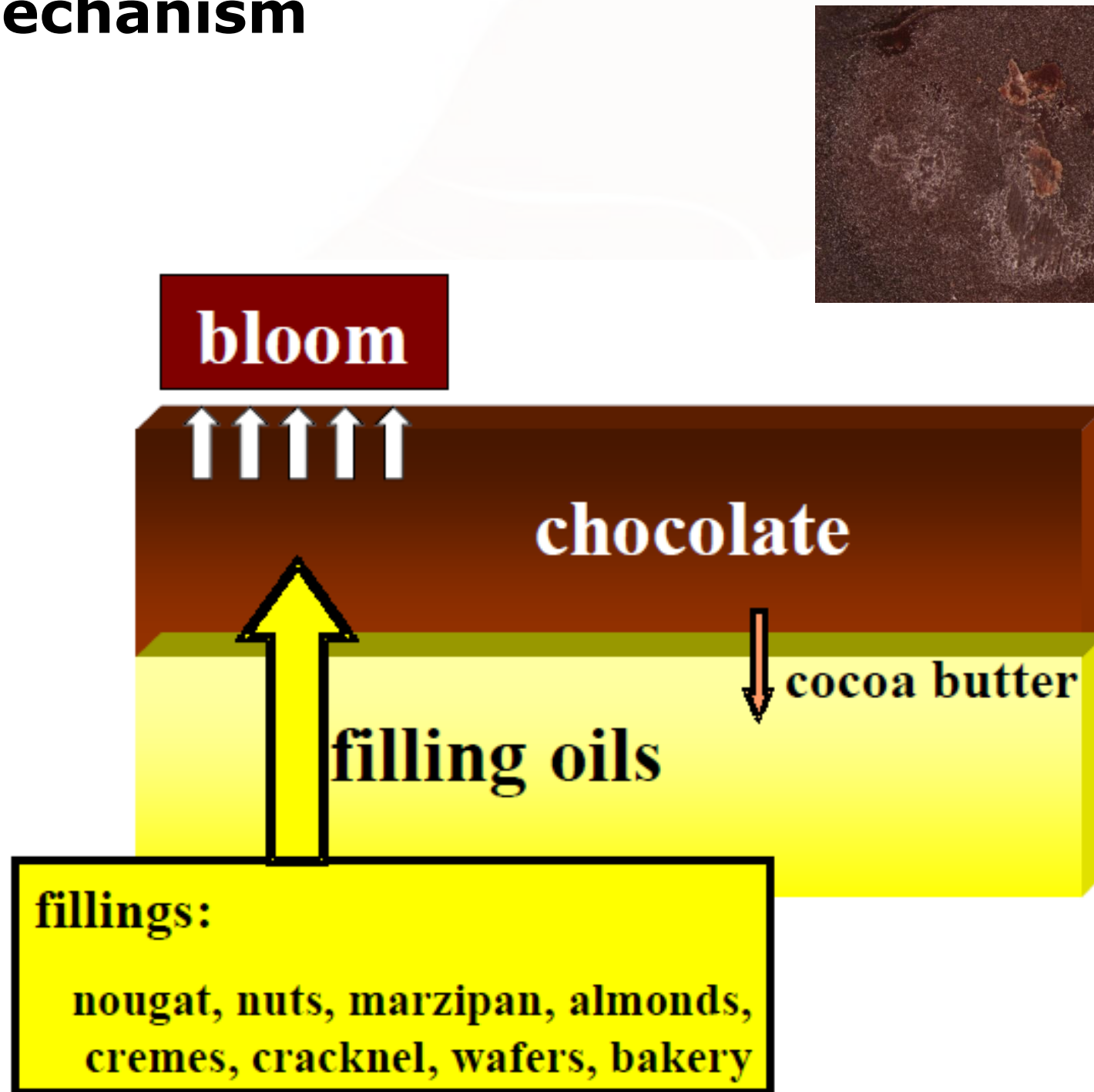


Methods to study oil migration: example

- TAG composition → HPLC-analysis



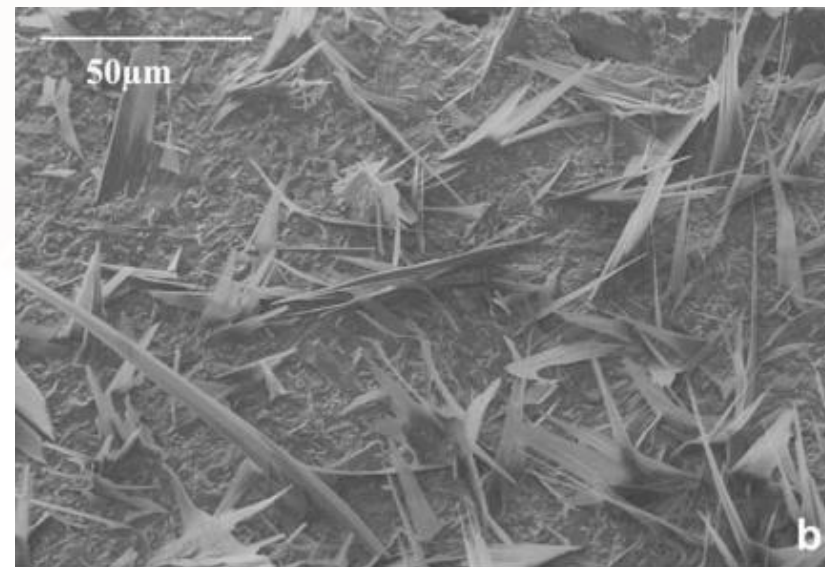
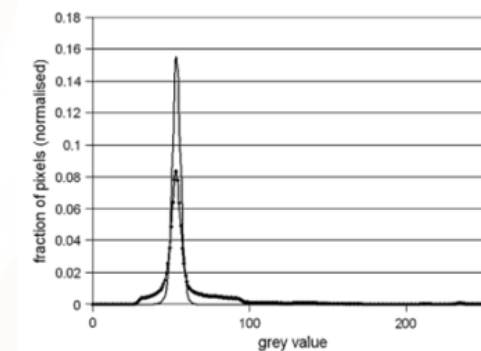
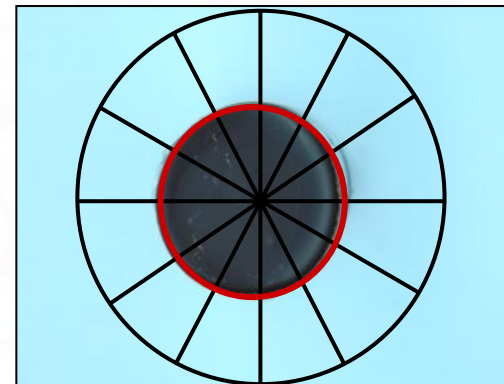
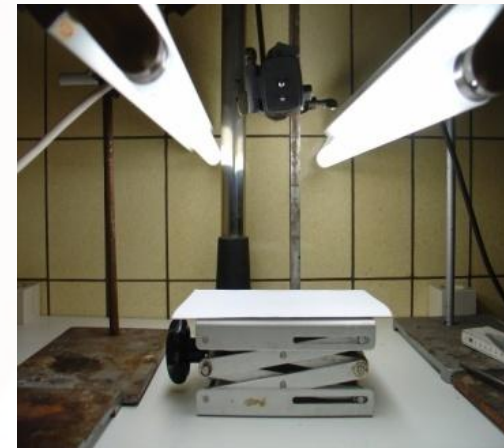
Mechanism



Ziegleder, 2006

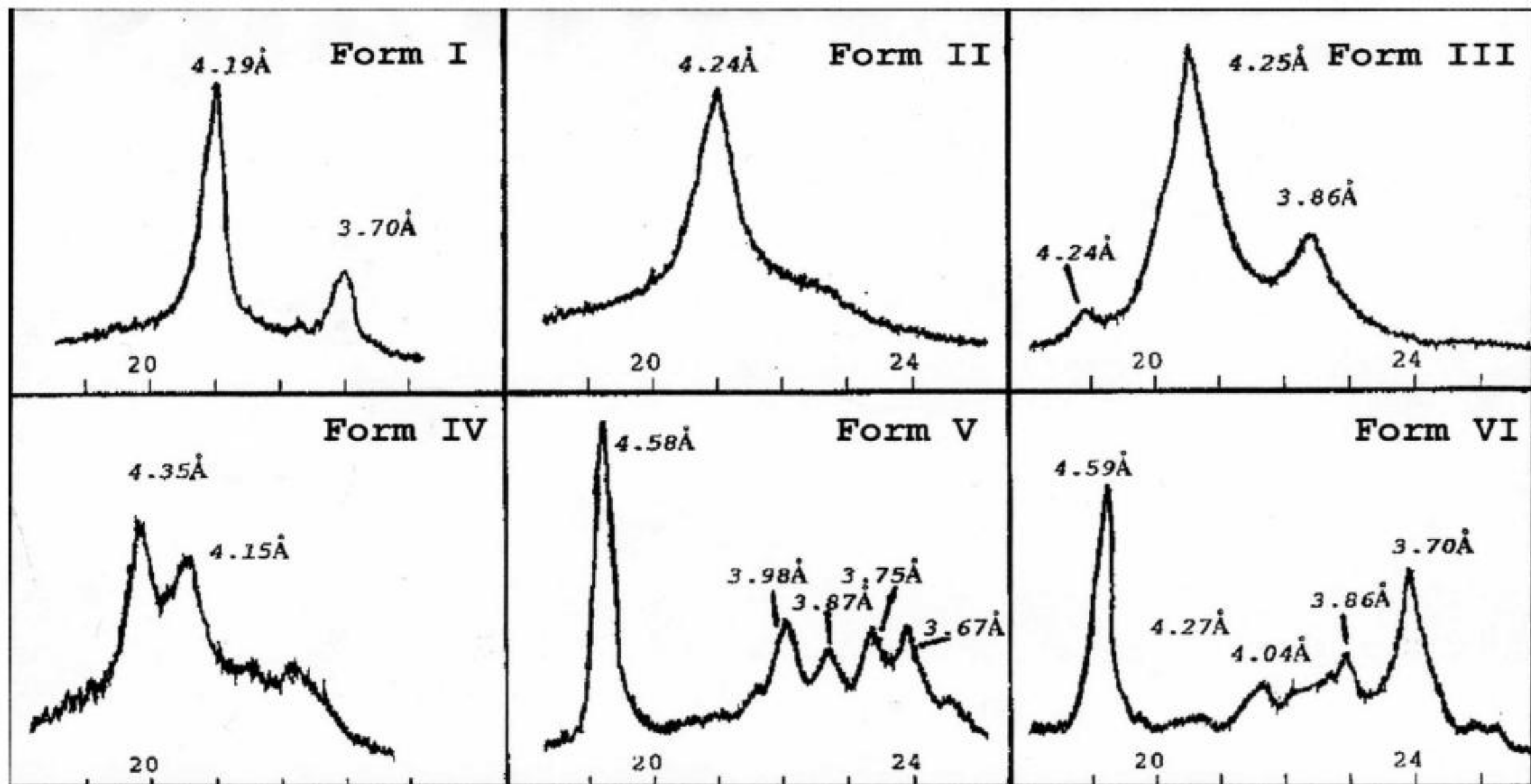
Methods to study visual fat bloom

- Image analysis
- Scanning electron microscopy
- Trained panel



Methods to study β^V – β^{VI} transition

- X-ray diffraction



Timms, 2003



How to prevent migration fat bloom?



- **Composition**
 - Fillings: the higher the liquid oil content, the higher the risk of fat bloom
 - If cocoa butter and filling fats are not compatible: softening effect
 - Addition of anti-blooming agents to chocolate and/or filling
- **Processing conditions**
 - Tempering
 - Shell thickness
 - Moulding technology
 - Cooling
- **Storage conditions**
 - Storage temperature of 15-18°C is recommended
 - Avoid fluctuating temperatures



How to prevent migration fat bloom?



Thermal treatments: storage at low temperatures

280

Eur. J. Lipid Sci. Technol. 2009, 111, 280–289

Research Paper

Triacylglycerol migration and bloom in filled chocolates: Effects of low-temperature storage

Frédéric Depypere, Nathalie De Clercq, Martien Segers, Benny Lewille and Koen Dewettinck

Cold storage after production decreased oil migration and fat bloom development in filled chocolates.

The results suggest a crystallization effect during cold storage, leading to permanent microstructural changes.

low positive temperatures immediately after production appears already beneficial in the prevention of visual fat bloom. Adverse effects of the thermal treatments on the chocolates' taste were not observed.

Keywords: Chilling and freezing / Hazelnut filling / Migration fat bloom / Milk chocolate / Thermal treatment

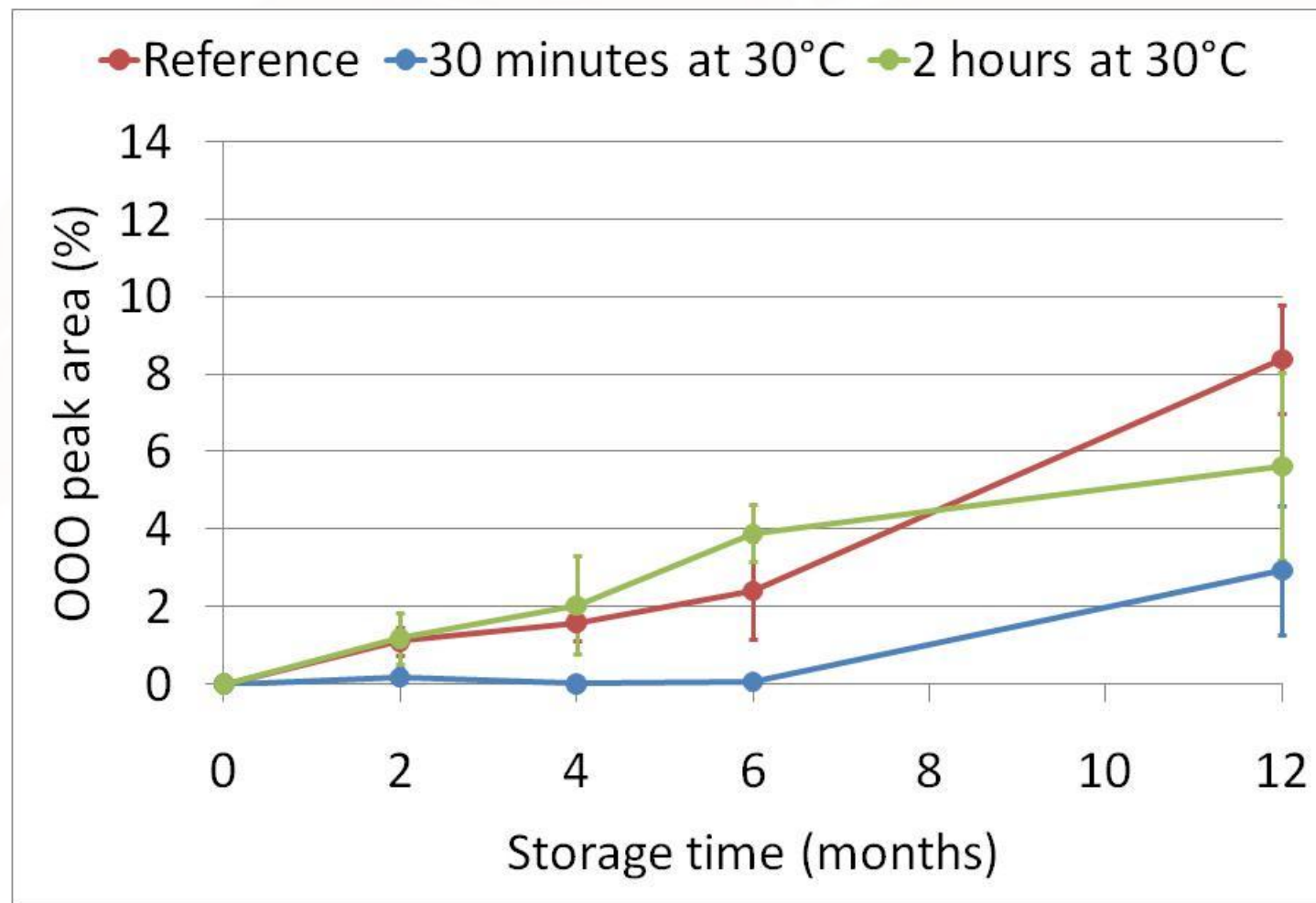
Received: July 15, 2008; accepted: October 27, 2008

DOI 10.1002/ejlt.200800179

Depypere *et al.* (2009)

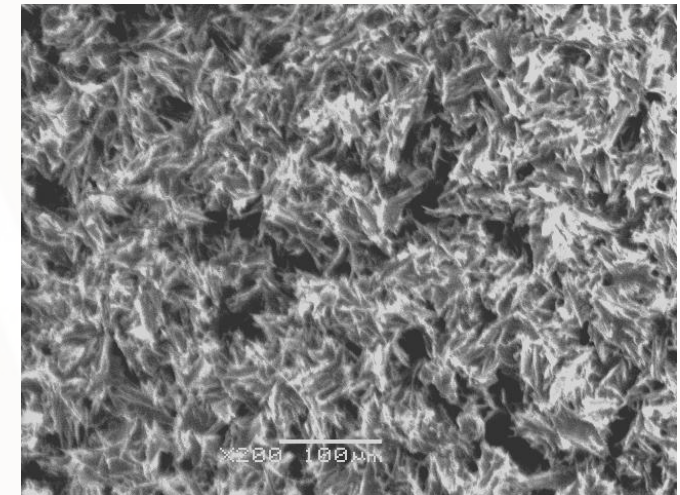


Thermal treatments: storage at high temperatures

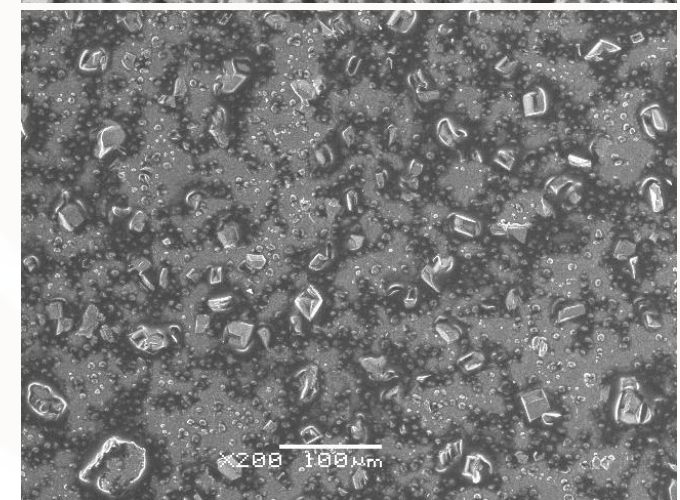


12 months at 20°C

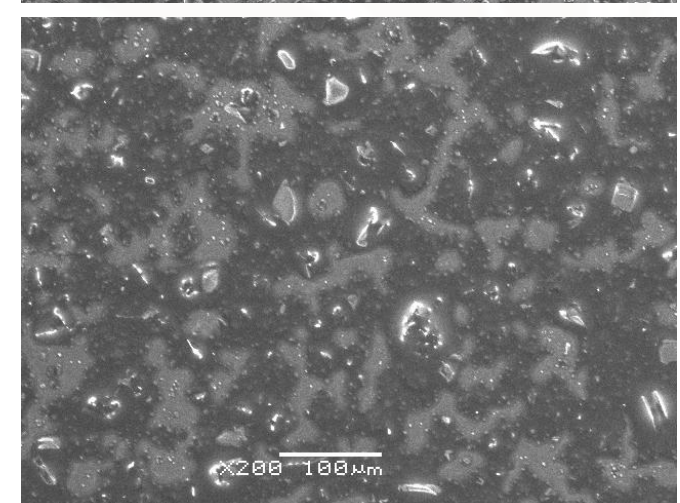
Reference



30 min/30°C




2 hrs/30°C



Thanks for your attention!

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