

AUTOMATED SYSTEM TO ASSESS STABILITY OF COMPLEX FORMULATIONS AT MACRO SCALE

Formula X

25/06/2019



Flamac activities

- Independant Open innovation platform
- High-throughput methodology experts
- Our missions:
 - **Accelerate** R&D in Material and Chemistry:
 - Miniaturization
 - Parallelization
 - **Automated** systems:
 - Accuracy
 - Reliability
 - Speed
 - Efficiency
- Joint projects with Academia/Industry



Flamac

A unique partner in advanced and accelerated materials development



Inks, paints & coatings



Polymers



Consumer goods



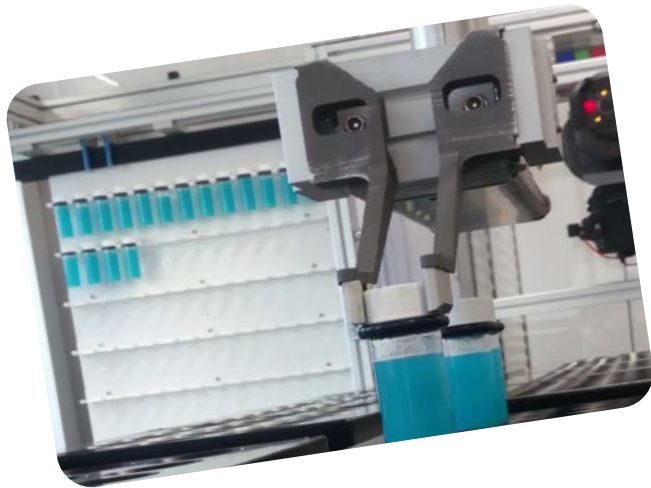
Alloys & ceramic materials



Solar cell materials

And many more ...

What is High-Throughput experimentation?



High-throughput experimentation

- Approach



Single

Macro scale

Manual

Slow and
human error

Parallel

Micro scale

Automated

Fast &
Reliable



Activities of FLAMAC

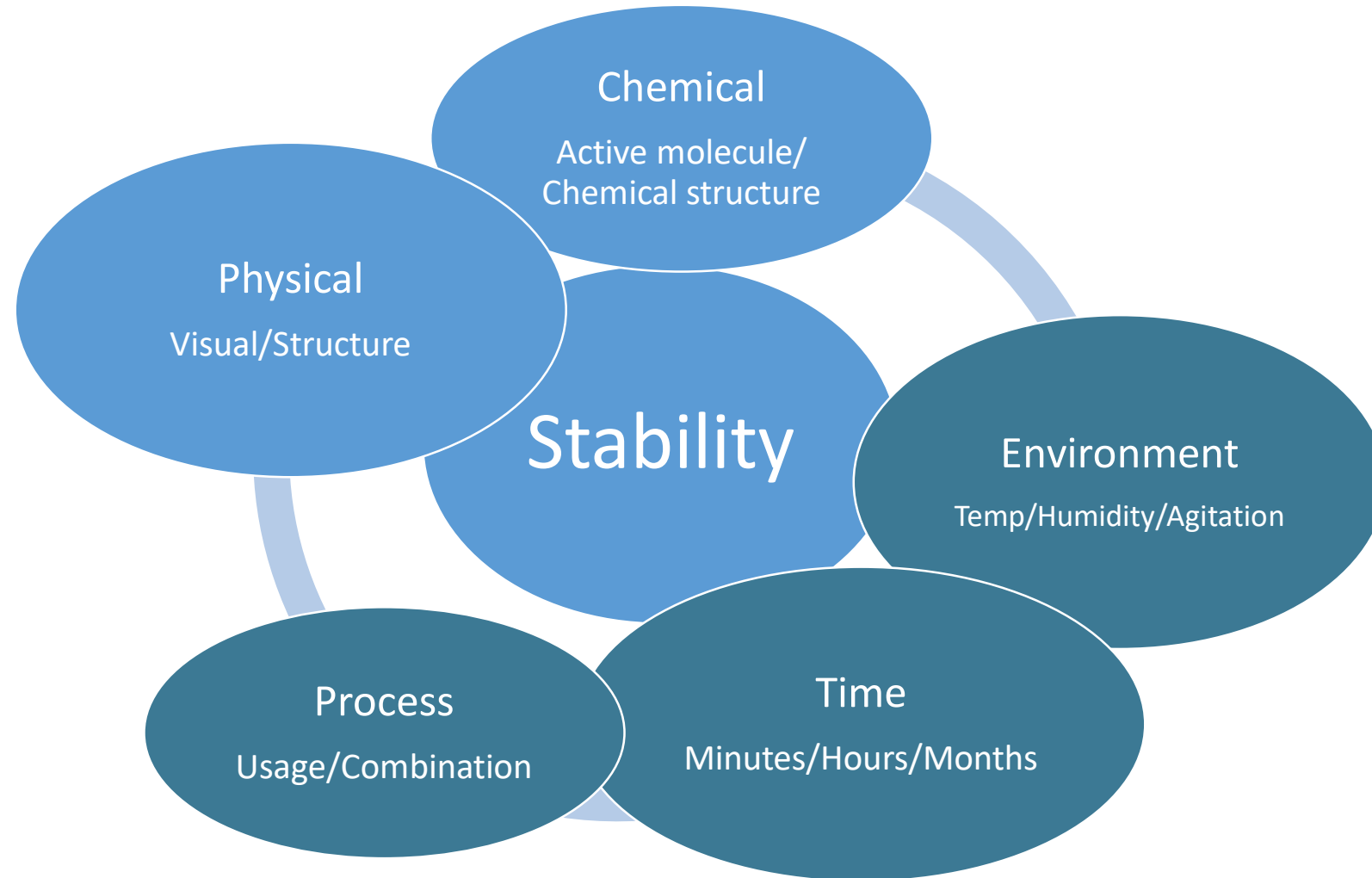
- Approach



Automated Stability tests



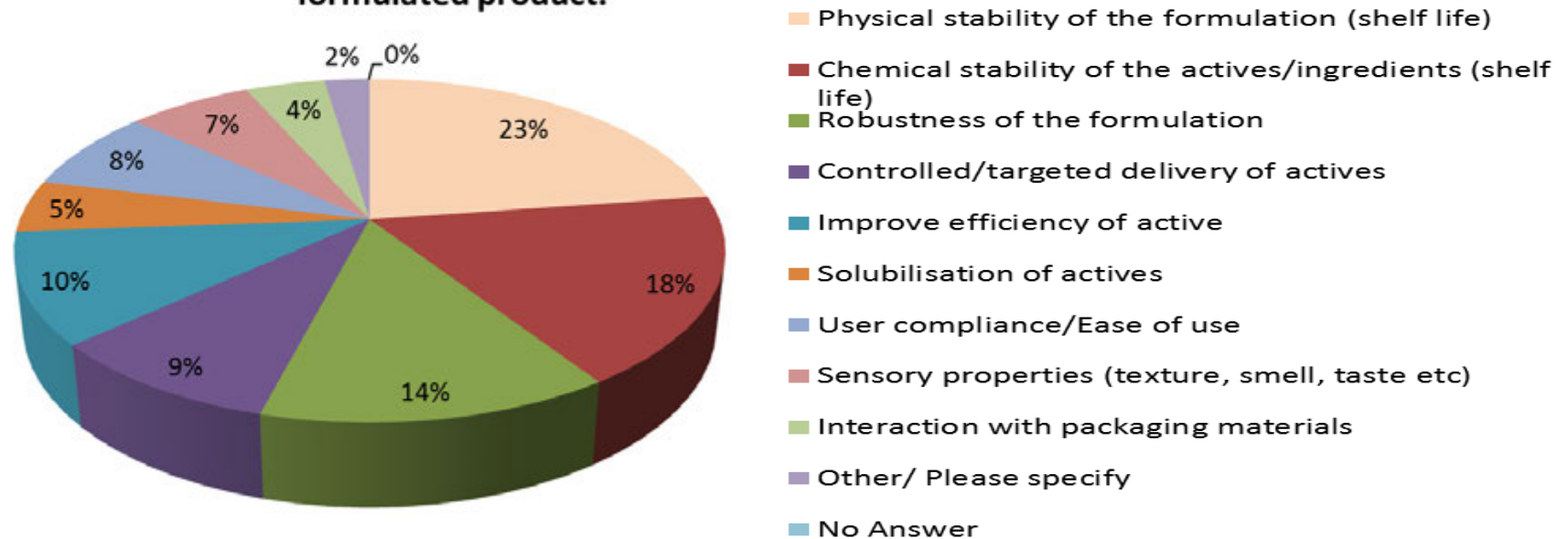
Stability and Formulation



Why should we talk about stability?

- From <https://formulation-network.eu/>

14. Please indicate what you consider are the 3 most important technical challenges with respect to the performance/quality of a formulated product.



Stability is the major challenge

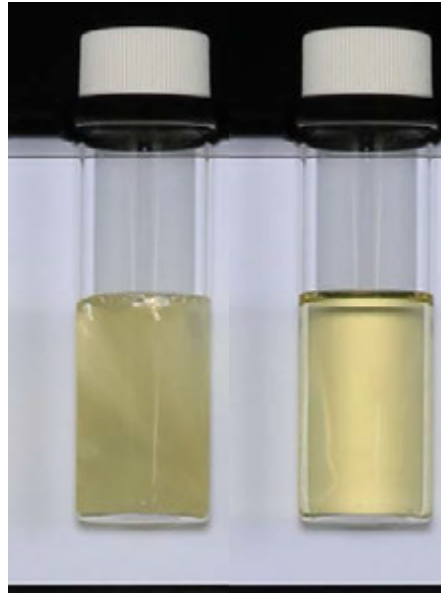
Stability and Formulation

- Stability from Lab to the User



Stability failure

- Crystallization



- Phase Split



- Loss of emulsion structure



- ...

From manual stability assessment

- How to test stability?
- Combination of:
 - Ageing: Storage at different temperatures
 - Testing: Characterization at pre-defined frequencies
- Consequences:
 - Expensive in time and manpower
 - Slow
 - Dependent on human precision and availability



To the automated stability platform

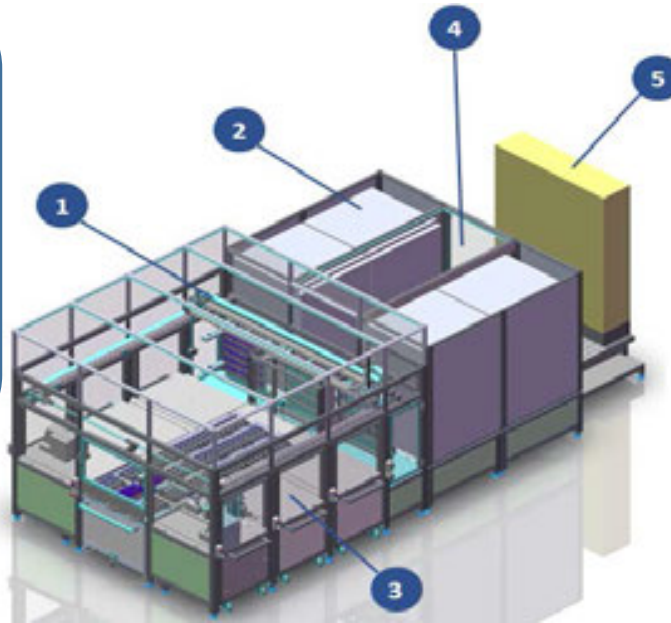
- Cross sector consortium
 - Flamac: Accelerated R&D expert
 - Nucomat: Lab automation company
 - P&G/Allnex: Industrial partners
- Design and build a system:
 - Automated sample handling
 - Automated characterization
 - Combinatorial ageing conditions
- Crucial aspects
 - Relevant capacity for industrial partners
 - Modularity for cross sector application



The automated stability platform

Characterization

- Imaging
- Rheology
- pH
- Turbidity
- Many More...



Ageing

- 4 Incubators
- Temperature of ageing from 0-60°C
- Storage capacity from 1280 to 2600 samples

Software

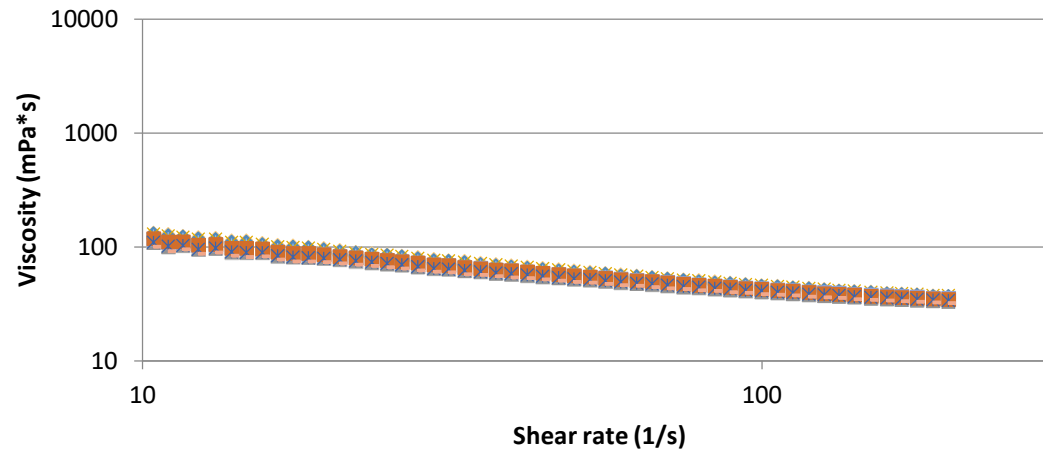
- Live supervision
- Remote access to standardized data



Automated platform benefits

- Combining measurement methods

RHEOLOGY



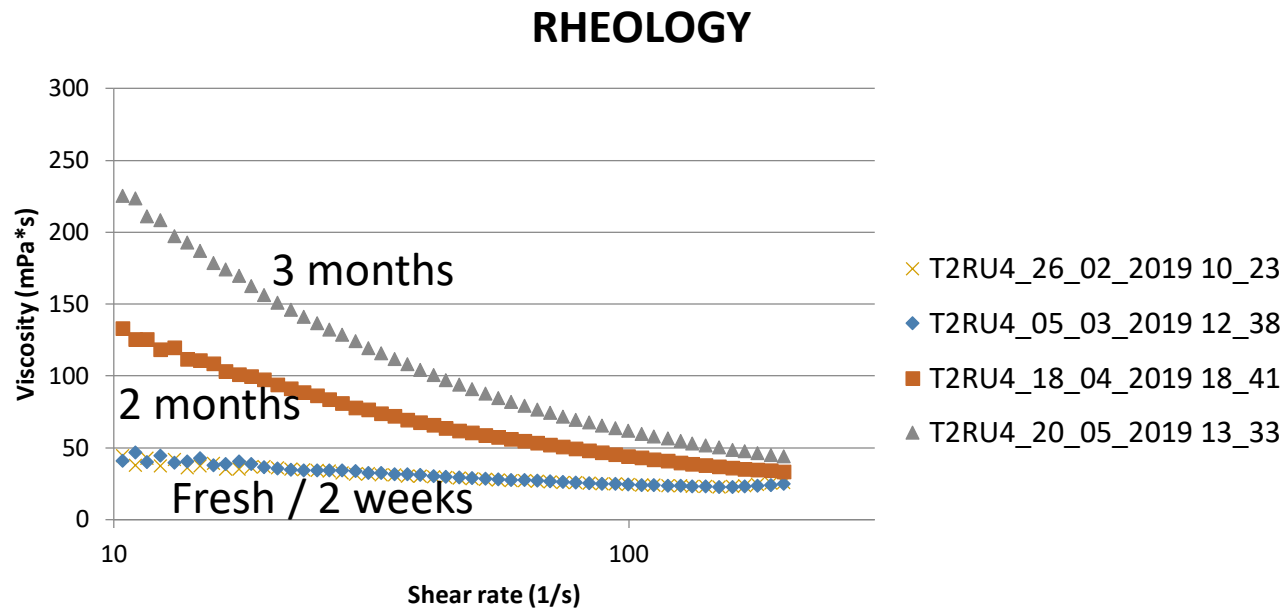
- T2RF2_26_02_2019 17_49
- T2RF2_14_03_2019 05_45
- ◆ T2RF2_05_04_2019 15_47
- + T2RF2_20_04_2019 23_48
- T2RF2_05_05_2019 11_15
- T2RF2_21_05_2019 07_00
- ▲ T2RF2_06_03_2019 08_13
- ◆ T2RF2_29_03_2019 15_45
- × T2RF2_12_04_2019 15_43
- T2RF2_29_04_2019 08_54
- × T2RF2_12_05_2019 11_12

T2RF2

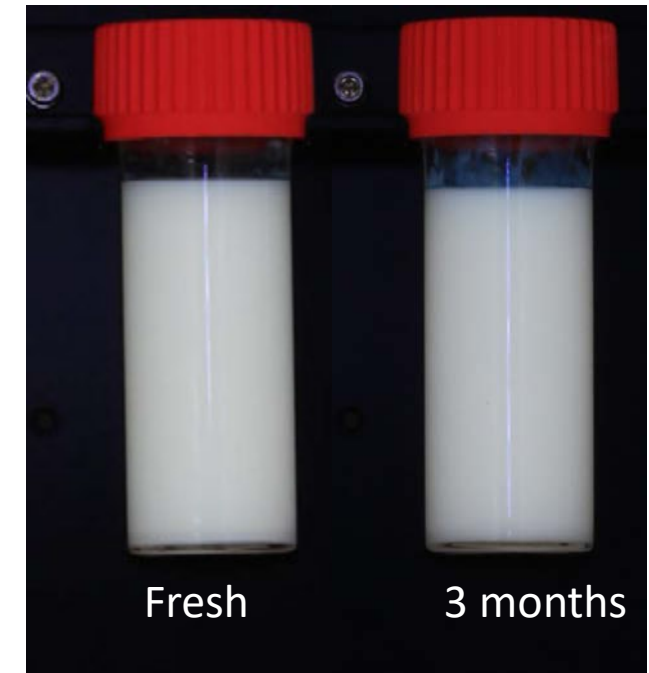


Automated platform benefits

- Combining measurement methods

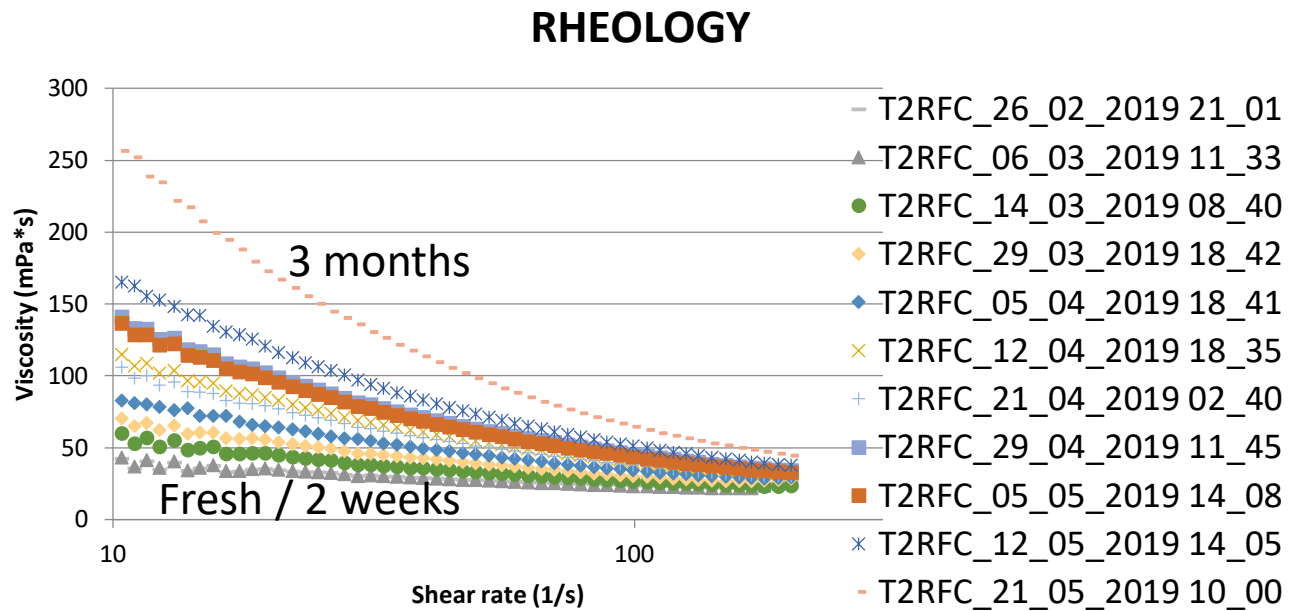


T2RU4



Automated platform benefits

- Measure more => Faster detection of failure

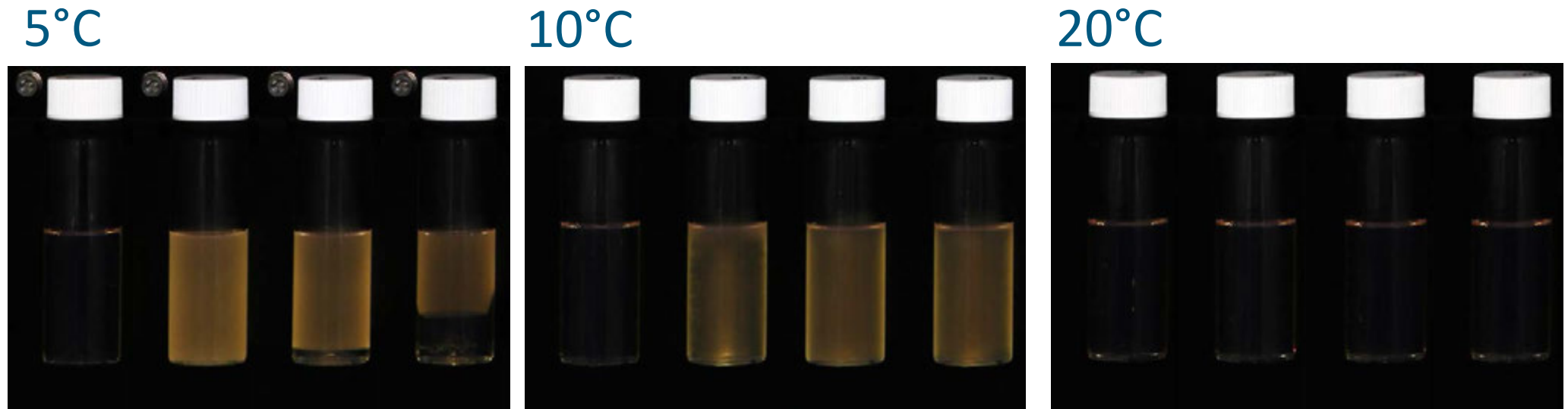


T2RFC



Automated platform benefits

- Intensive imaging for Temperature and Time stability screening
 - Down to 1 picture/hour
 - Up to 2600 samples

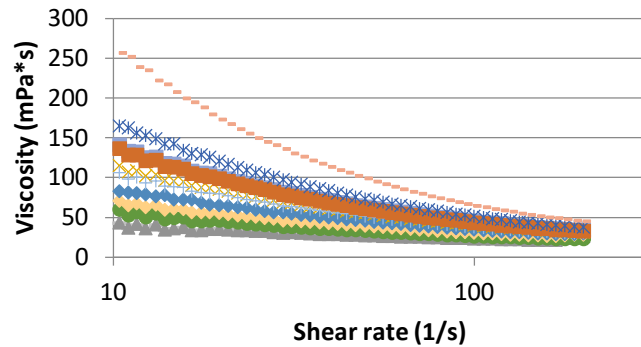


t0 - 4h - 1week - 2weeks

Automated platform benefits

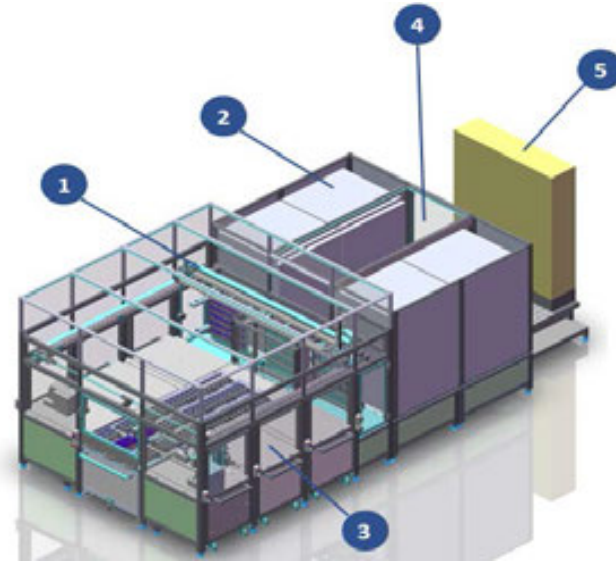
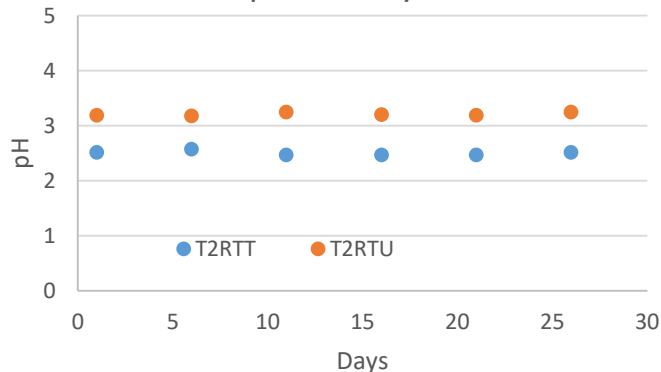
- Perfect combination with HTP Formulation for Stability mapping

RHEOLOGY

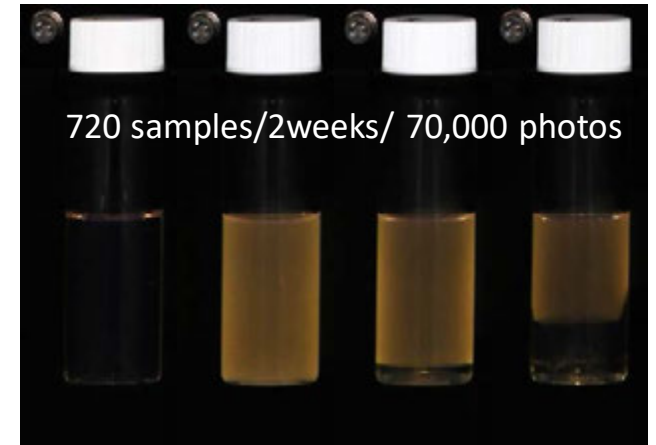


180 samples/3 months/ 1356 pH & 1356 Rheology measurements

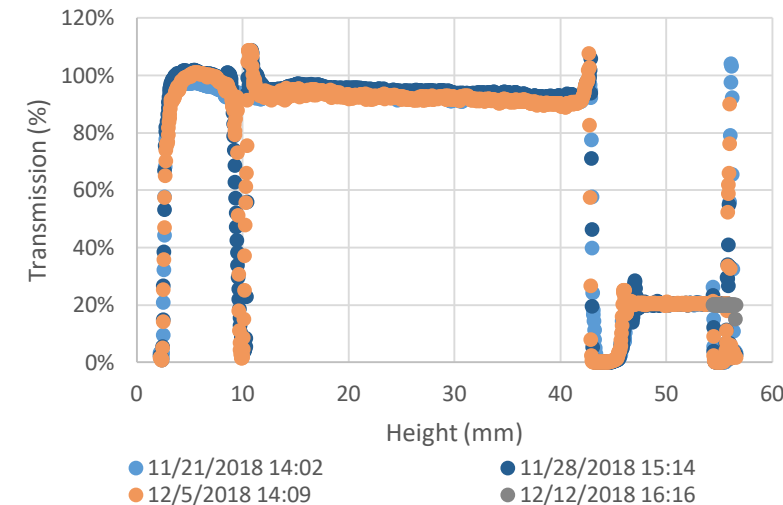
pH stability



Mine of Data



Turbiscan Signal



Automated platform benefits

- Increase the number of samples to be tested
 - Up to 2600 samples
- Increase the frequency of measurements
 - Daily measurement
- Increase the reproducibility of the measurements
 - Robotic precision
- Open the field of Shelf life/Supply chain stability evaluation and modelling
 - Unlimited temperature combination
 - Standardized Data library for data mining/AI

Financial aspects:

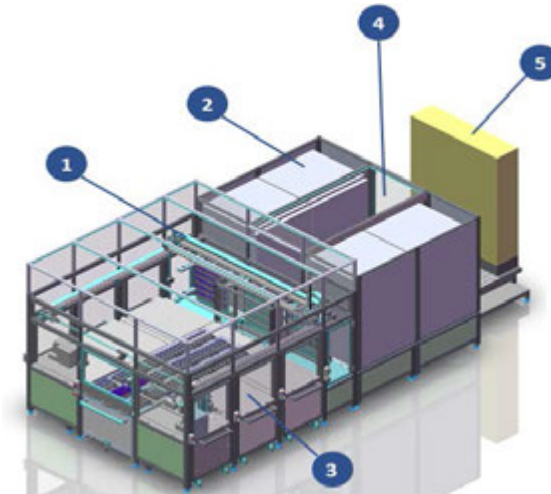
Reduced manpower (x3)

Cost per sample divided by 2 to 10



An open Innovation platform looking for partners

- Collaboration:
 - At National/European level for funded project
 - Under contract research
 - Between experts: Accelerated R&D experts / Formulation experts



Demo video Nucomat: <https://www.youtube.com/watch?v=wK4N3iZawtM>

Looking forward to collaborate



Flamac

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