



Understanding the interactions between natural surfactant/co-surfactant of Alkyl polyglucoside/Fatty alcohol type through pseudo-ternary phase diagram

Daria Terescenco, Celine Picard, Géraldine Savary, Florence Clemenceau, Michel Grisel

► To cite this version:

Daria Terescenco, Celine Picard, Géraldine Savary, Florence Clemenceau, Michel Grisel. Understanding the interactions between natural surfactant/co-surfactant of Alkyl polyglucoside/Fatty alcohol type through pseudo-ternary phase diagram. IFSCC 2016, Oct 2016, Orlando, United States. 276, pp.189 - 205, 2006. hal-02566824

HAL Id: hal-02566824

<https://normandie-univ.hal.science/hal-02566824>

Submitted on 11 May 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Understanding the interactions between natural surfactant/co-surfactant of Alkyl polyglucoside/Fatty alcohol type through pseudo-ternary phase diagram

Terescenco Daria^a, Picard Céline^a, Savary Géraldine^a, Clemenceau Florence^b, Grisel Michel^{a*}

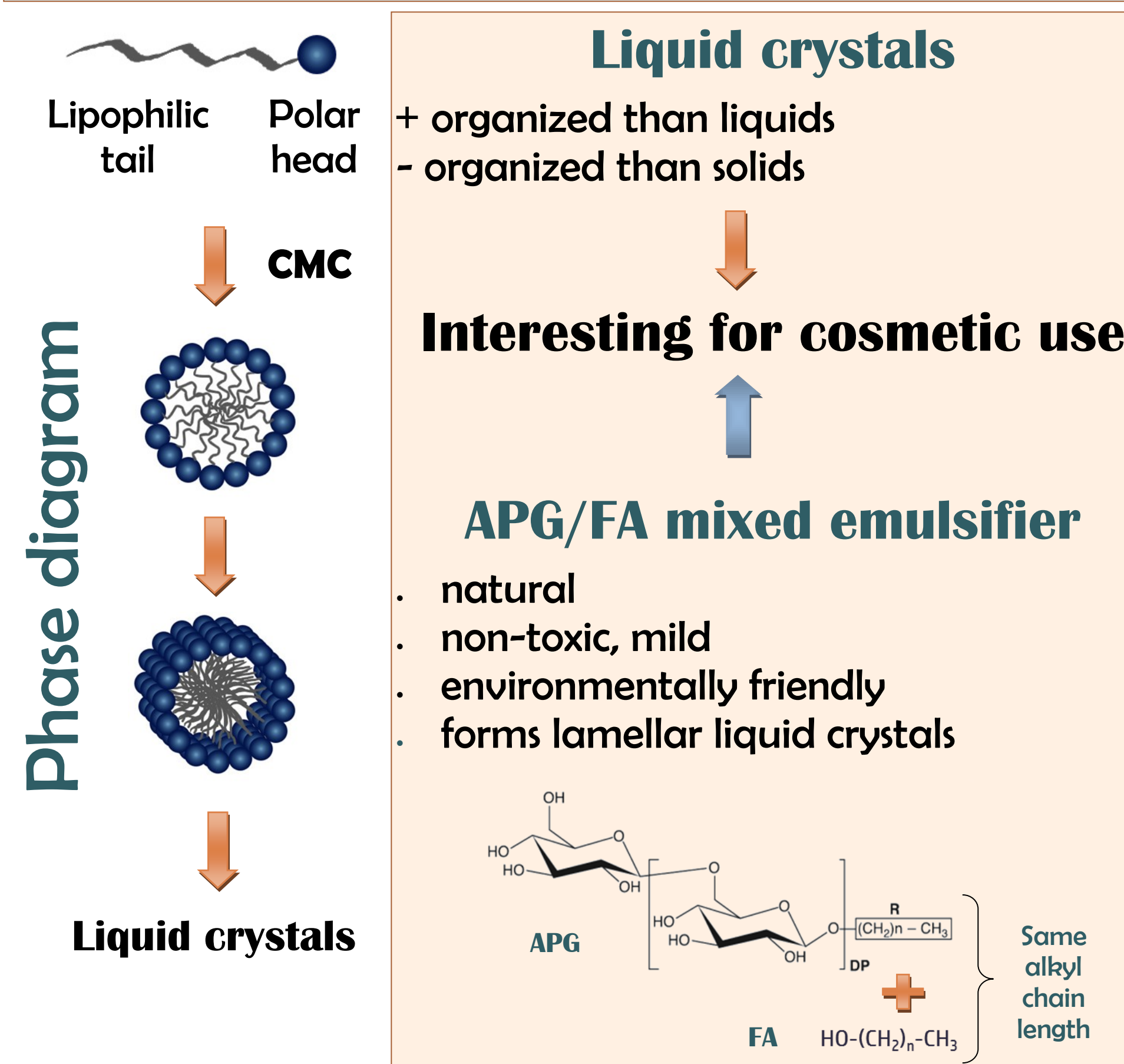
[a] Normandie Univ, UNIHAVRE, FR 3038 CNRS, URCOM, 76600 Le Havre, France

[b] Direction Innovation - UID Excipients SEPPIC, 127 Chemin de la Poudrerie, 81105 Castres Cedex, France

Aim

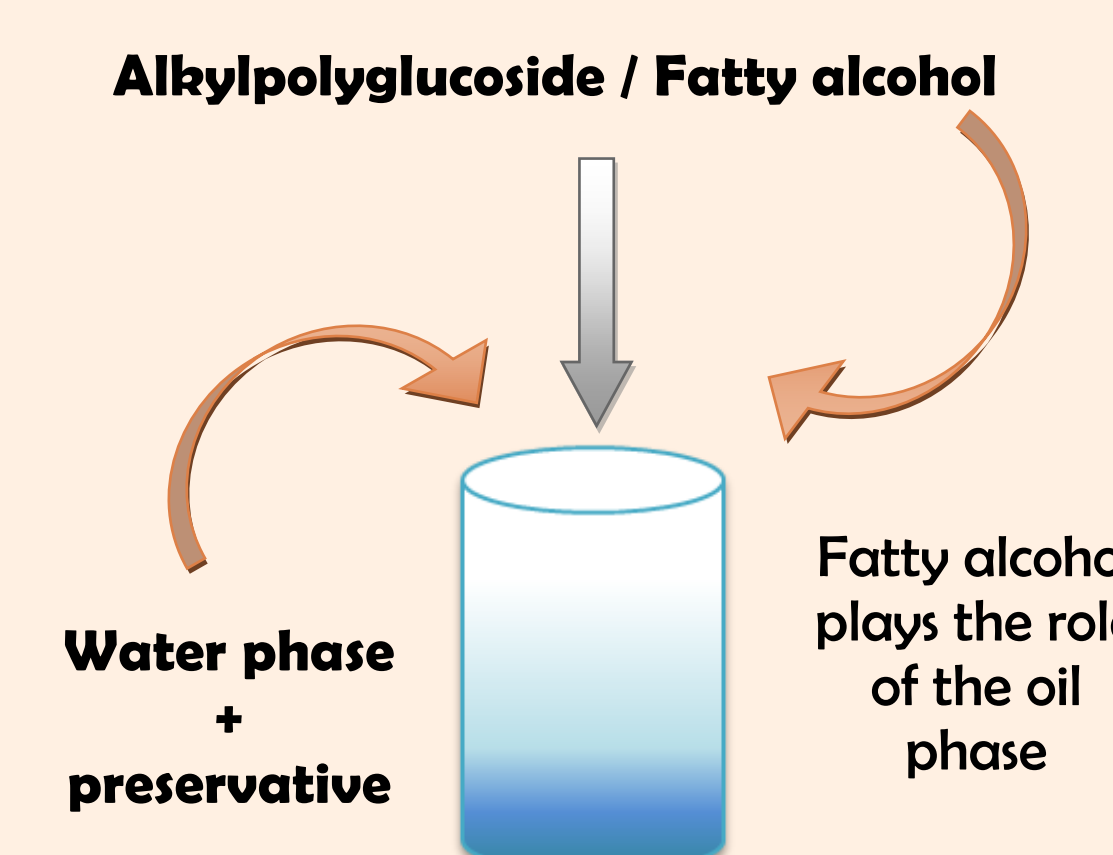
Investigation of possible interactions between the surfactant alkyl polyglucoside (APG) and the co-surfactant fatty alcohol (FA) through the pseudo-ternary phase diagram, mapped at 25°C. Transition between the fundamental research on the mixed surfactant behavior towards its interest in cosmetic field.

Introduction



Systems & Methods

Systems - auto emulsions



APG/FA	% of use in auto-emulsions
84.5/15.5	0.5% → 30%
20/80	0.5% → 30%

Rheology

Oscillatory tests:

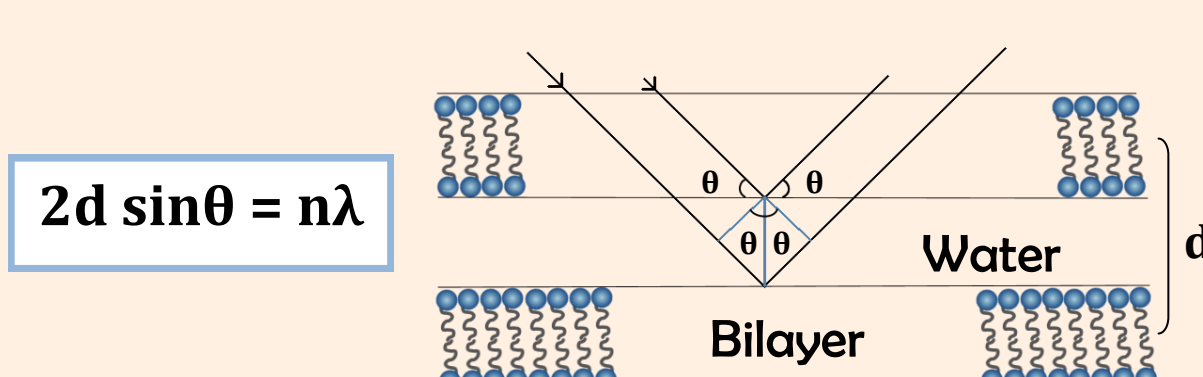
Strain sweep — viscoelastic domain

Frequency sweep — liquid crystal phases specific behavior

G' - storage modulus
 G'' - loss modulus
 $\tan \delta = G''/G'$

Wide-angle X-ray diffraction

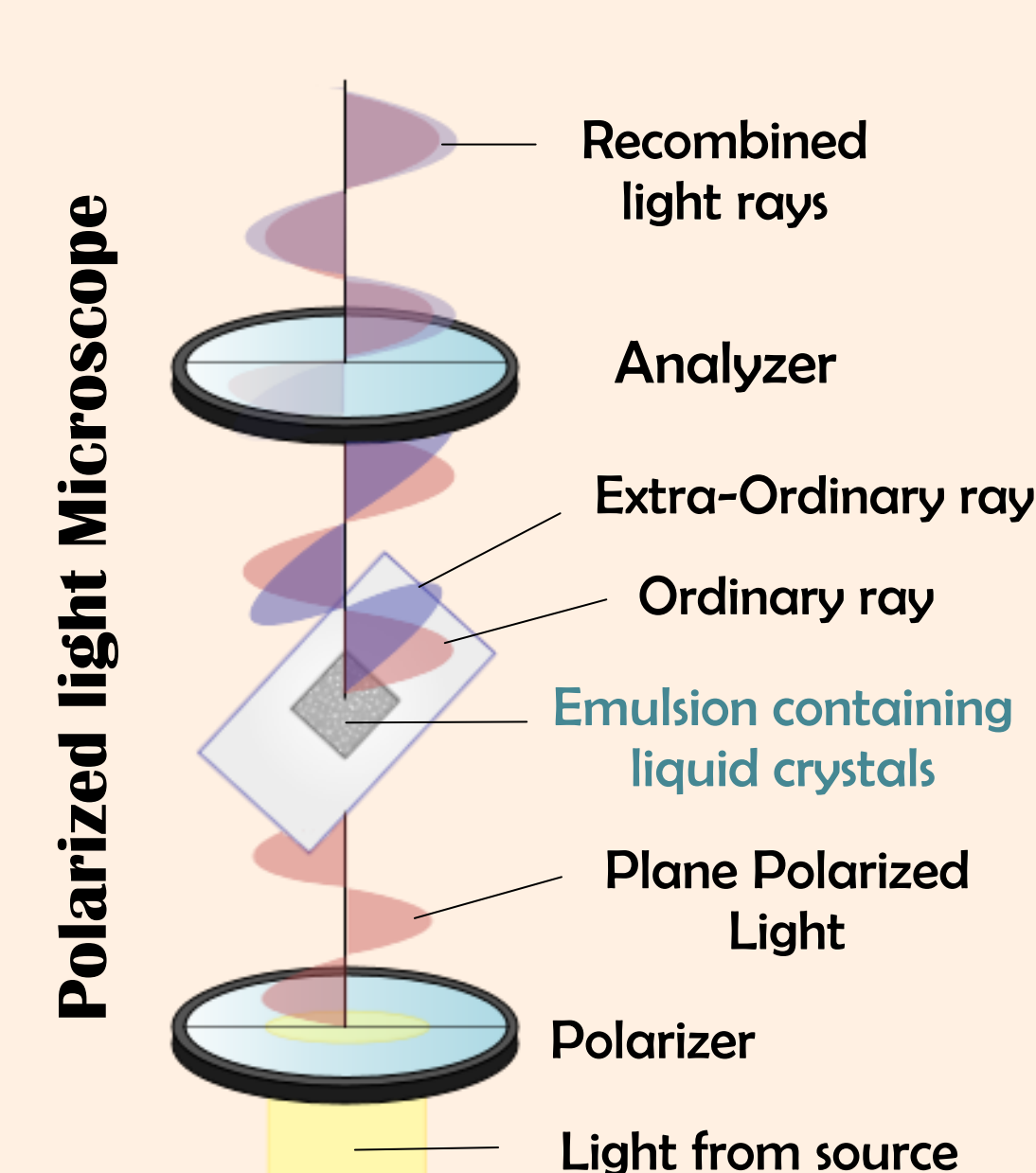
$d \rightarrow$ the liquid crystal organization.
WAXD was mostly applied to lamellar phase analysis



Microscopy

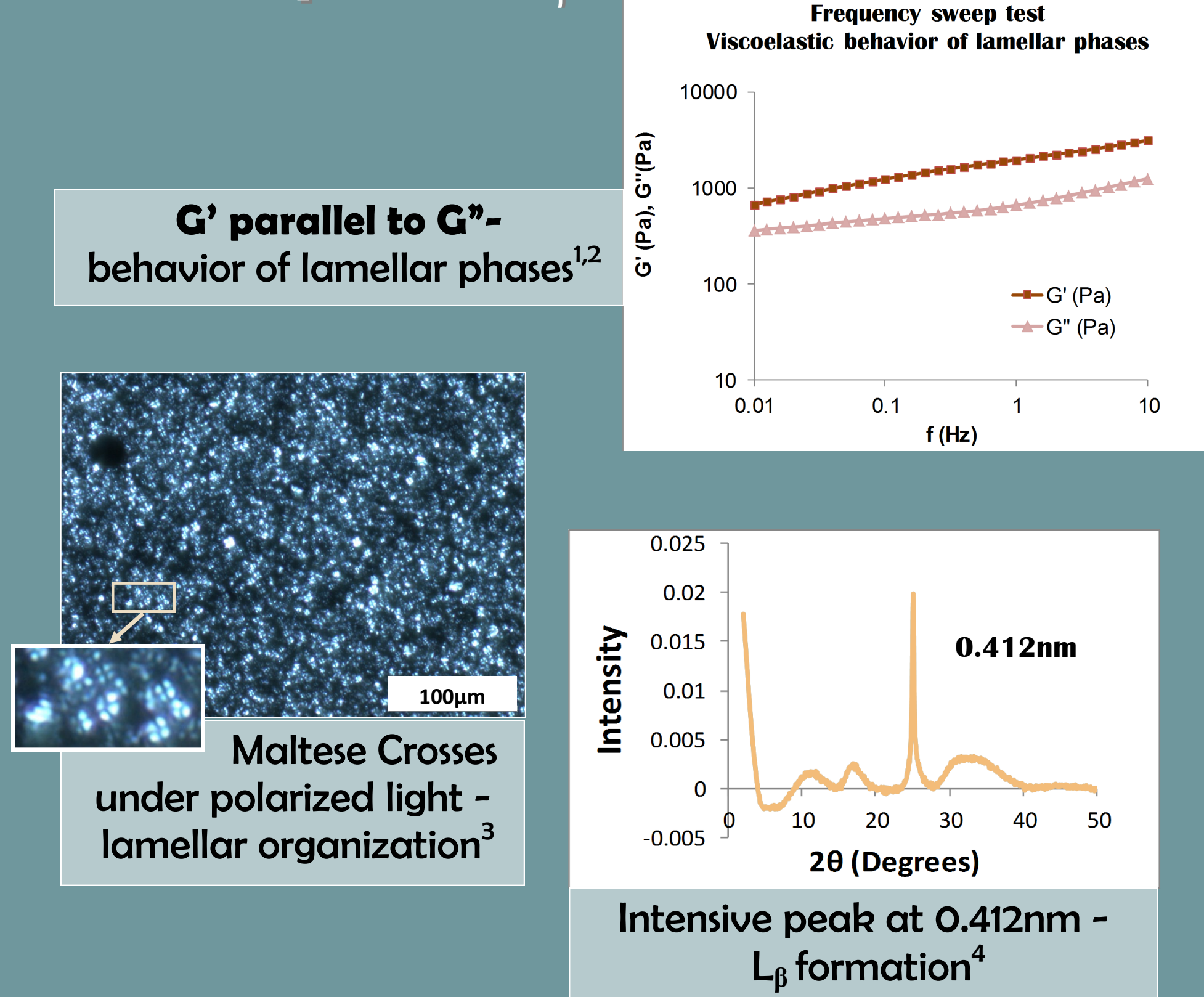
Bright light microscopy

Cross-polarized light microscopy — observation of birefringent structures

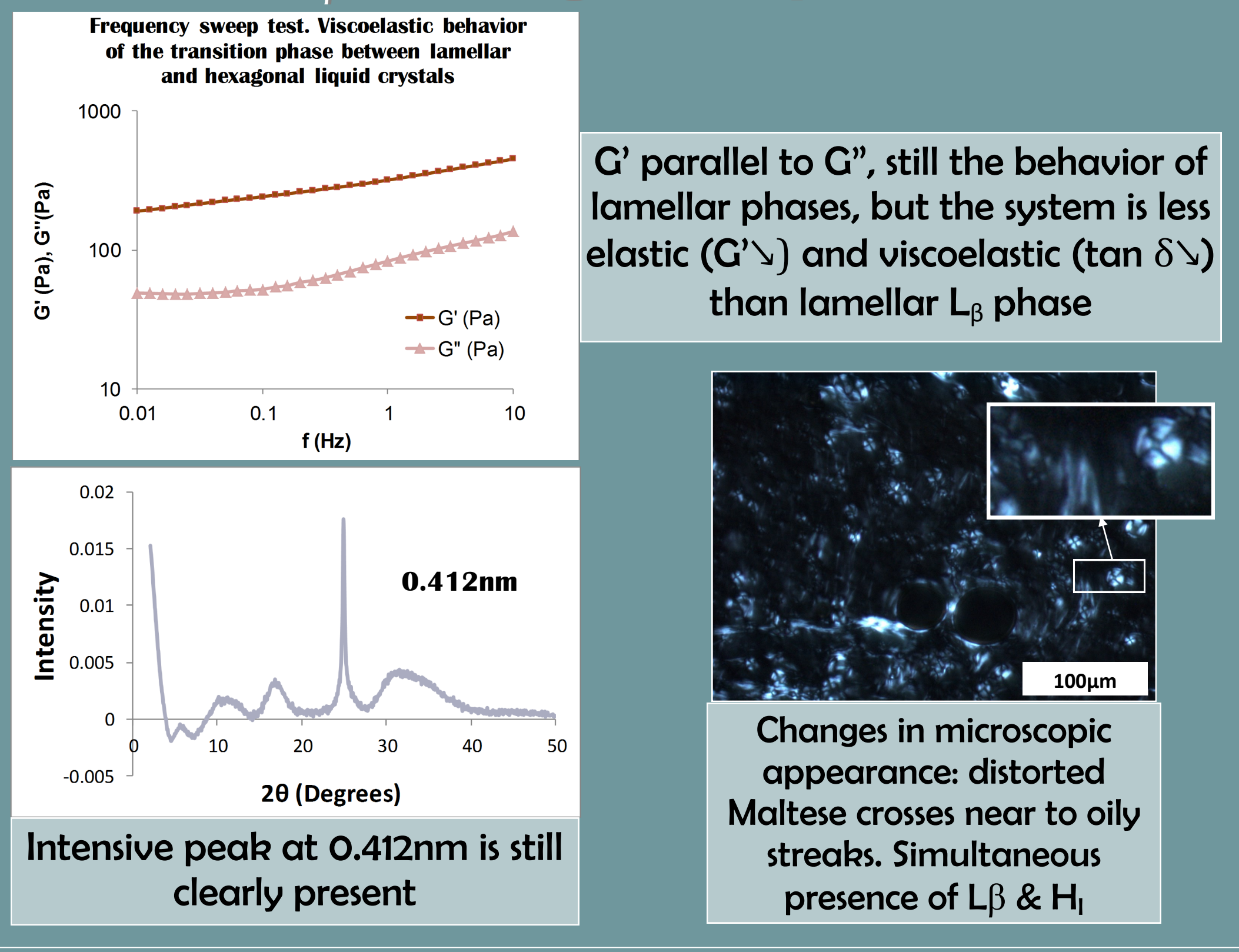


Results - Phase diagram

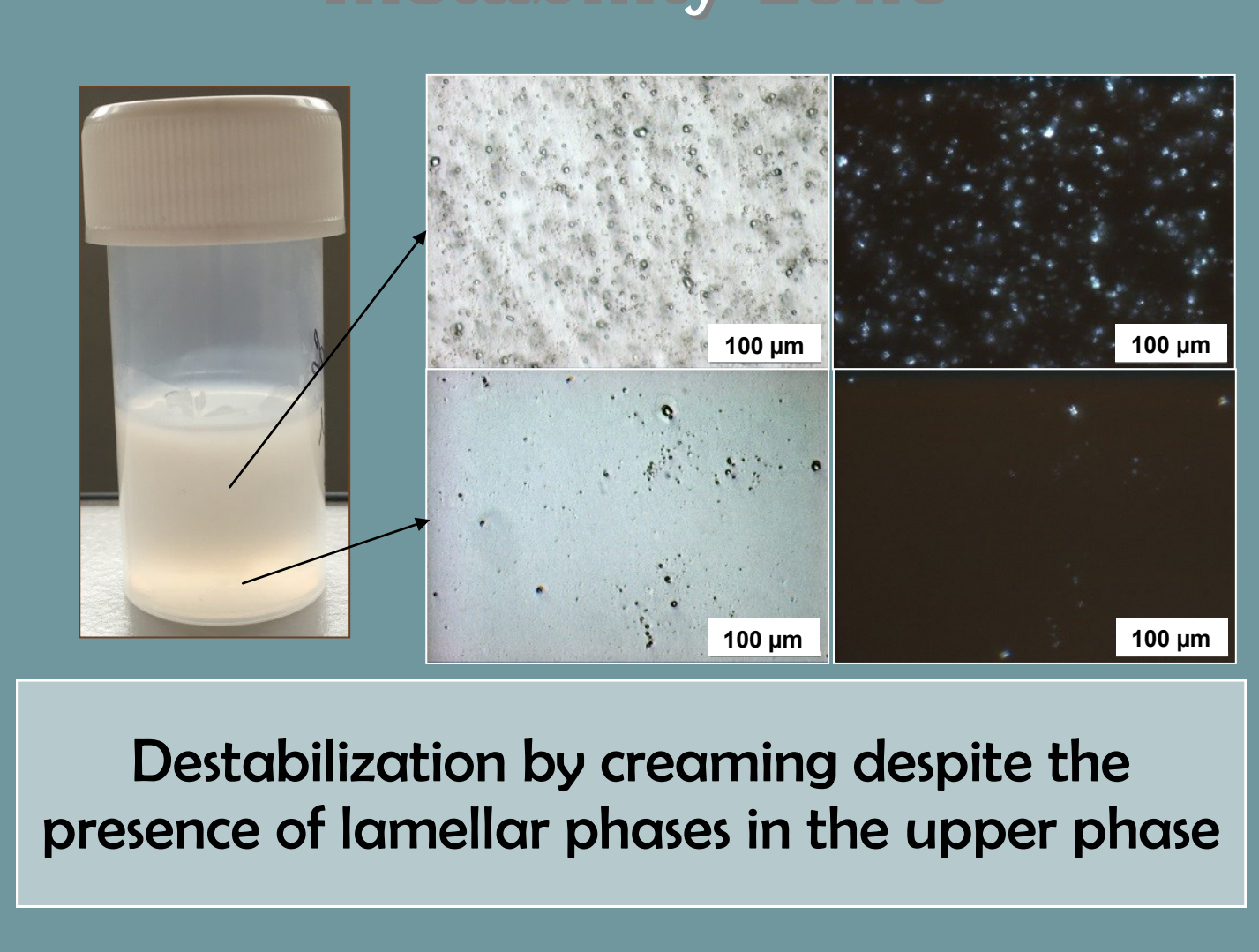
Lamellar phase - L_β



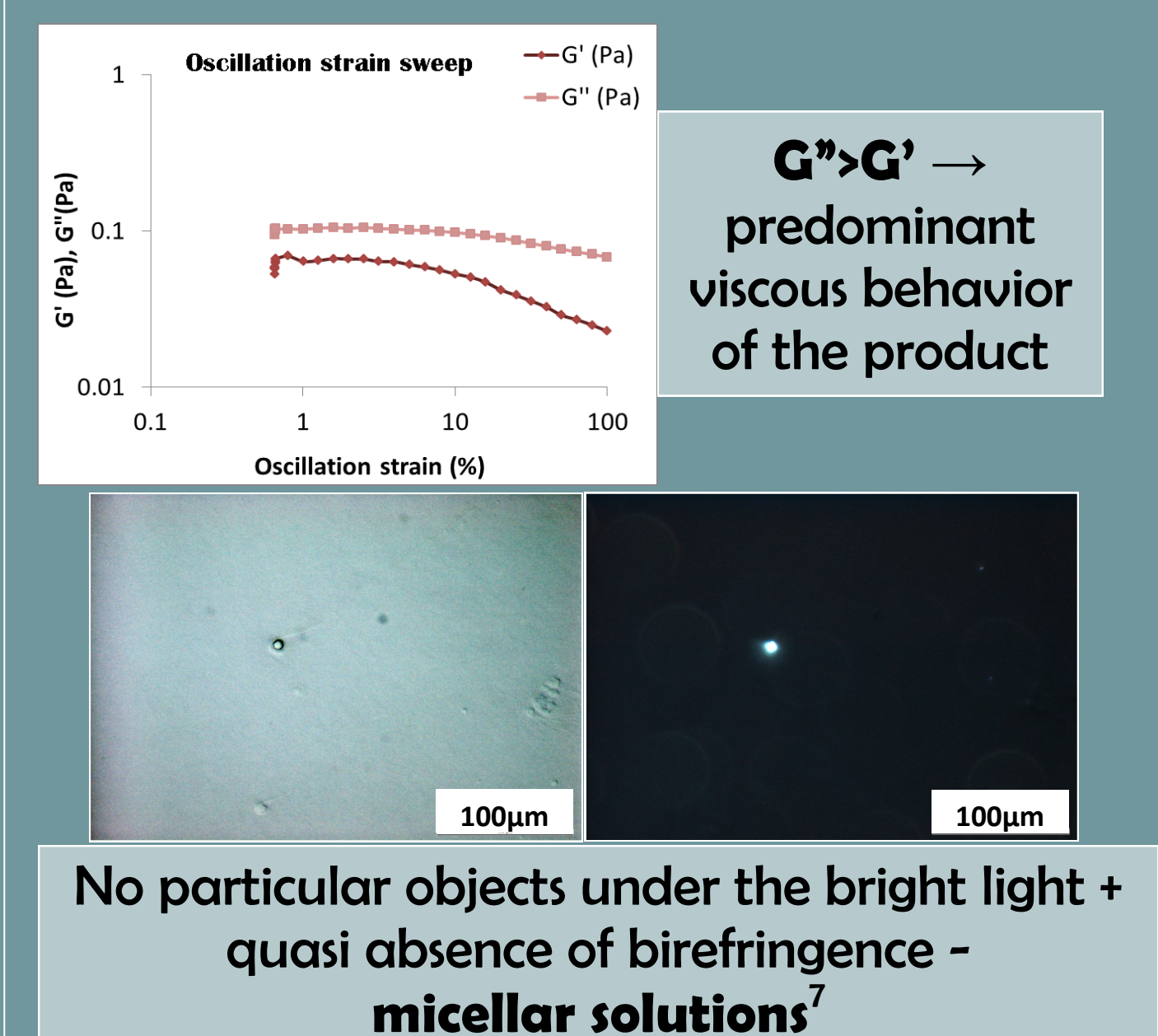
Lamellar L_β to hexagonal H_i phase transition



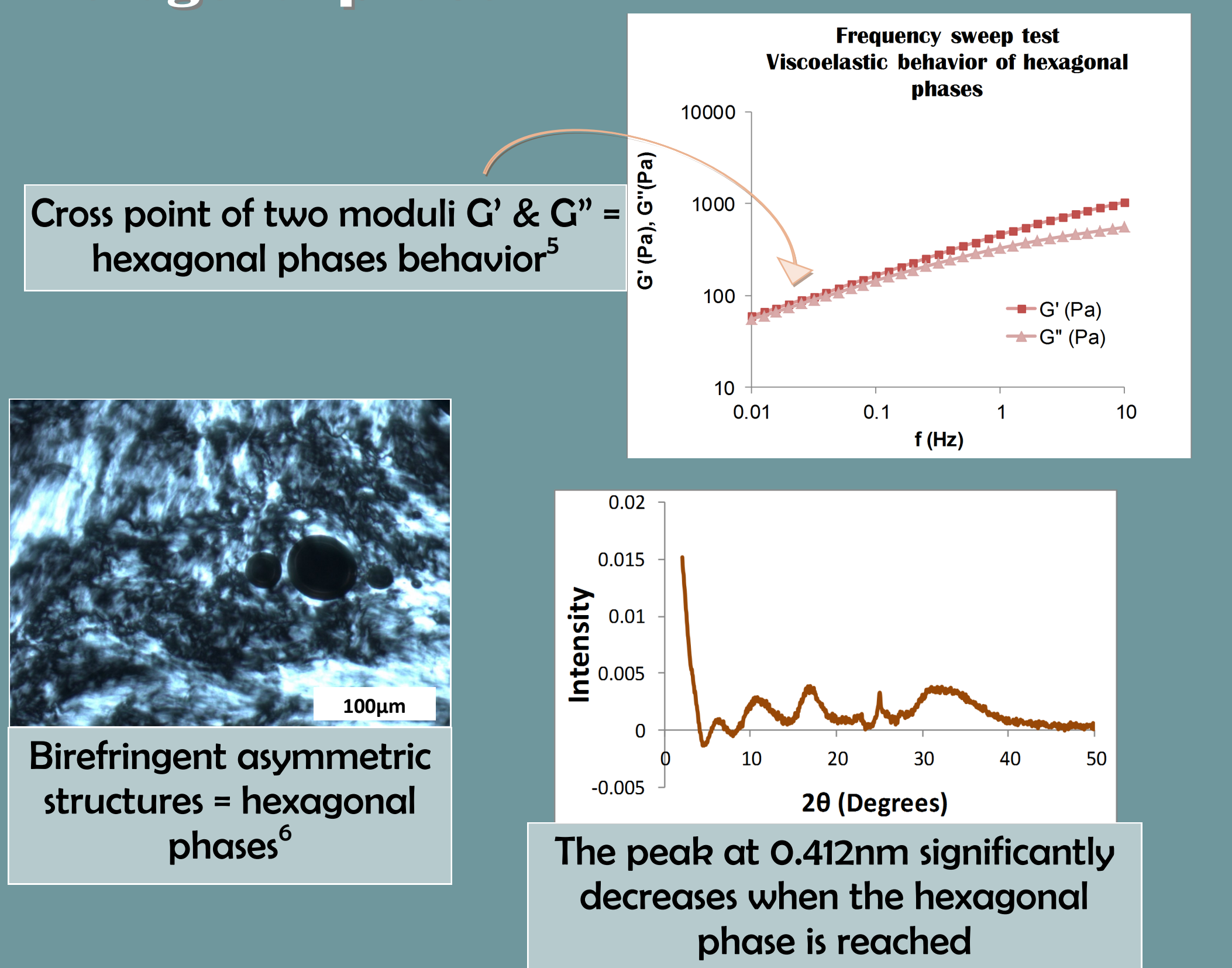
Instability zone



Micellar solution - L_1



Hexagonal phase H_i



Conclusion

From fundamental and industrial point of view:

- Controlling the ratio of an emulsifier/co-emulsifier mixture = controlling the liquid crystalline form(s) of the system;
- Controlling the liquid crystalline forms of the system = controlling the microscopic & macroscopic properties of final formulations.

References

- ¹Siddig, M.A., Radiman, S., Jan, L.S., Muniandy, S.V. (2006). Rheological behaviours of the hexagonal and lamellar phases of glucopone (APG) surfactant. *Colloids Surf. Physicochem. Eng. Asp.* 276, 15–21.
- ²Németh, Z., Halász, L., Pálkás, J., Bóta, A., Horányi, T. (1998). Rheological behaviour of a lamellar liquid crystalline surfactant-water system. *Colloids Surf. Physicochem. Eng. Asp.* 145, 107–119.
- ³Savic, S., Vuleta, G., Daniels, R., Müller-Goymann, C.C. (2004). Colloidal microstructure of binary systems and model creams stabilized with an alkylpolyglucoside non-ionic emulsifier. *Colloid Polym. Sci.* 283, 439–451.
- ⁴Fairhurst, C.E., Fuller, S., Gray, J., Holmes, M.C., Tiddy, G.J.T., Demus, D., Goodby, J., Gray, G.W., Spiess, H.-W., Vill, V. (1998). *Lyotropic Surfactant Liquid Crystals*, in: *Handbook of Liquid Crystals* Set, Wiley-VCH Verlag GmbH, pp. 341–392.
- ⁵Montalvo, G., Valiente, M., Rodenas, E. (1996). Rheological Properties of the L Phase and the Hexagonal, Lamellar, and Cubic Liquid Crystals of the CTAB/Benzyl Alcohol/Water System. *Langmuir* 12, 5202–5208.
- ⁶Włodzimierz Sulek, M., Bak, A. (2010). The Effect of Liquid Crystalline Structures on Antiseizure Properties of Aqueous Solutions of Ethoxylated Alcohols. *Int. J. Mol. Sci.* 11, 189–205.
- ⁷Platz, G., Thunig, C., Pöliche, J., Kirchhoff, W., Nickel, D. (1994). Phase behaviour of alkyl polyglucosides in combination with fatty alcohols and alkyl sulphates. *Colloids Surf. Physicochem. Eng. Asp.* 88, 113–122.