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Visualization of capilary Laboratory of Tribology and phenomena at the origin Dynamics of Systems of "framing effect" of UMR 5513 liquid coatings M Delory^{1)2)3)*}, B Chorein²⁾, AC Brulez²⁾, T Fiorani³⁾, N Grosjean⁴⁾, L Mees⁴⁾, S Benayoun¹⁾

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1. CONTEXT

• "Framing effect" : coating defect due to



1cm

28mN/m 26mN/m

4. PTV MATERIALS AND EXPERIMENTAL SET-UP

Clearcoat formulated in the lab with fluorescent particles (PMMA spheres doped with Rhodamine B, 1-20µm, <0,1%) Coating application under PTV setup with hand coater (100µm) Surface tension additive are added at 0%, 0,13% and 0,46% ullet

different capillary phenomena resulting in a coating excess at the edges of coated substrate

 Recent studies consider substrate curvature radius, film thickness and coating viscosity as major parameters for framing effect formation

2. PRELIMINARY RESULTS

- Coating formulation and application
- Topography measurement with profilometry
- First experiments : surface tension have a major influence on framing effect for small surface tension variation (\pm 1mN/m).





5. PTV ANALYSIS AND RESULTS

Screenshot of PTV video :

profil(m

WHICH PHYSICO-CHEMICAL PHENOMENA IS DRIVING **THESE TOPOGRAPHY CHANGES ?**

3. KINETIC OF THE TOPOGRAPHY EVOLUTION

- Visual perception is sensitive towards slope and curvature variation rather than altitude variation : deflectometry is a technique suitable for framing effect analysis
- Upper curvature correspond to the bump curvature
- Two antagonists phenomena are observed :

Progressive Minimum of curvature before a Of decrease curvature : the bump is flattened final increase : the bump is flattened and then raised



- All coating formulations showed a first phase of spreading away from the edge (due to Laplace Law)
- Only formulations without surface tension additive show intense and persistant convection flows
- Formulations with low surface tension additive shows small convection flows





time (s)

6. CONCLUSION

- Different flow behaviours depend on coating formulation and surface tension
- Surface-tension additive modify flow behaviour and therefore framing effect topography









