UNIVESITY OF AMTERDAM
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The Value of Grey Literature in providing Exposure to Scientific Research: Case in Point – Creeping of Salt Solutions

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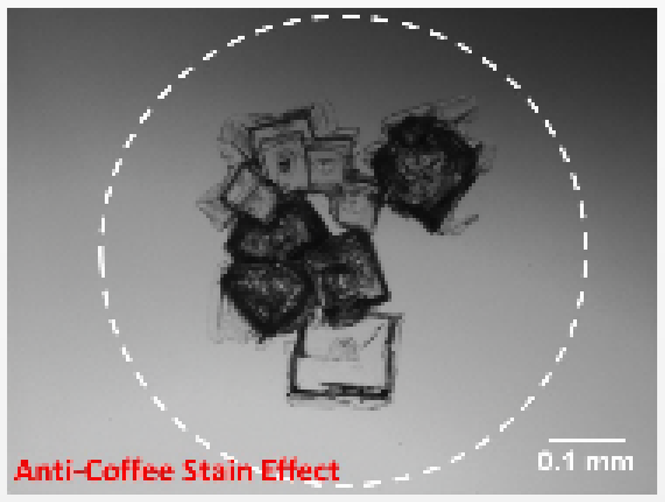
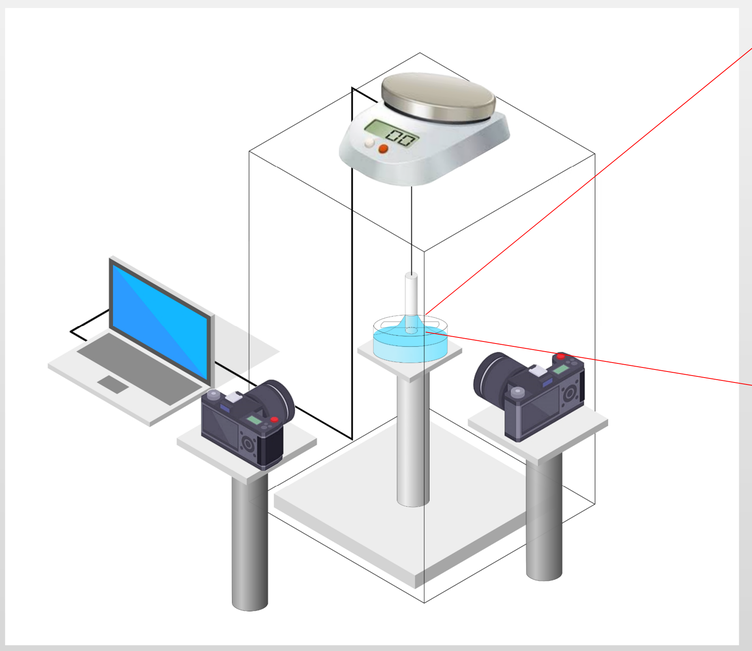
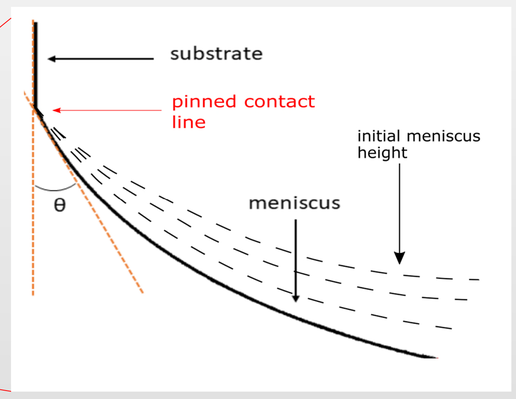
Introduction

- Creeping is a phenomenon of crystal growth from evaporating solutions in which the crystals spread beyond the solution boundary (i.e. contact line with the substrate).
- Understanding the creeping phenomenon is crucial for various phenomenon like soil sodification and the industrial applications where high salt concentrations are used.



Experimental Setup

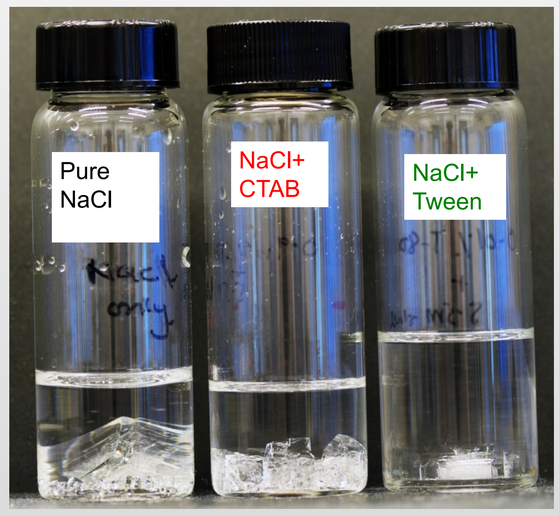




- Experiments done at different Relative humidities.
- Contact angle analysis during evaporation up to creeping
- Measurement of Mass in time

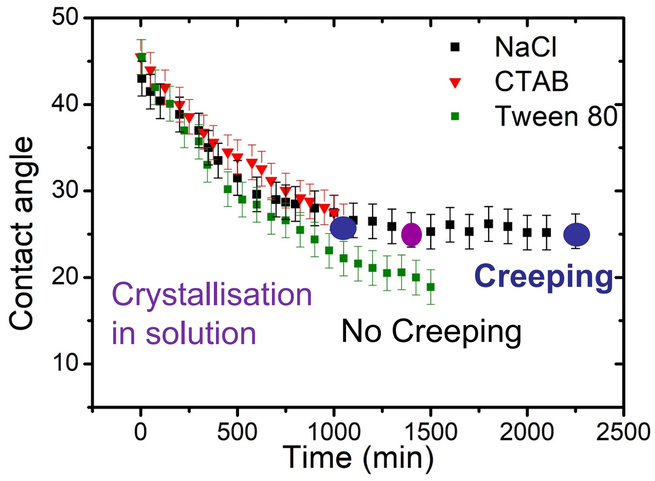
Salt Used:
- Sodium Chloride

Surfactant Used:
- CTAB (Crystallisation Promoter)
- Tween 80 (Crystallisation inhibitor)



Few Nuclei | Multiple Nuclei | Single Crystal

Evolution of Contact angle



Model for Growth

- **Growth Rate:**

$$\frac{dm}{dt} = \mathrm{C} \times S_0 \quad (S_0 = \text{Initial surface area})$$

- **More crystals precipitation increases the surface area**
- New surface area:

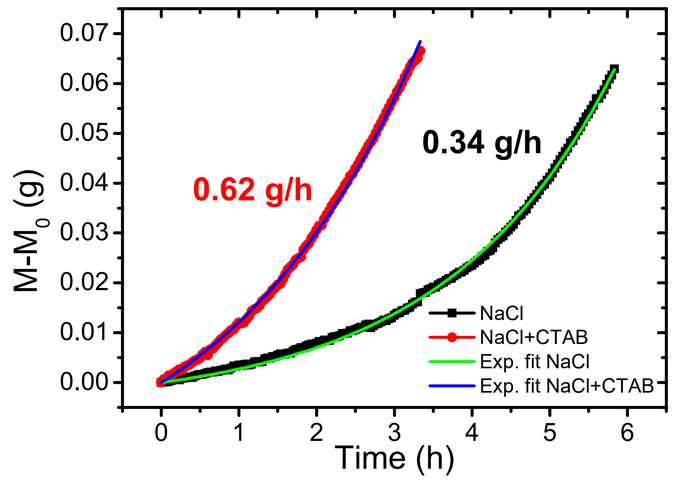
$$S = S_0 + C\, m(t)$$

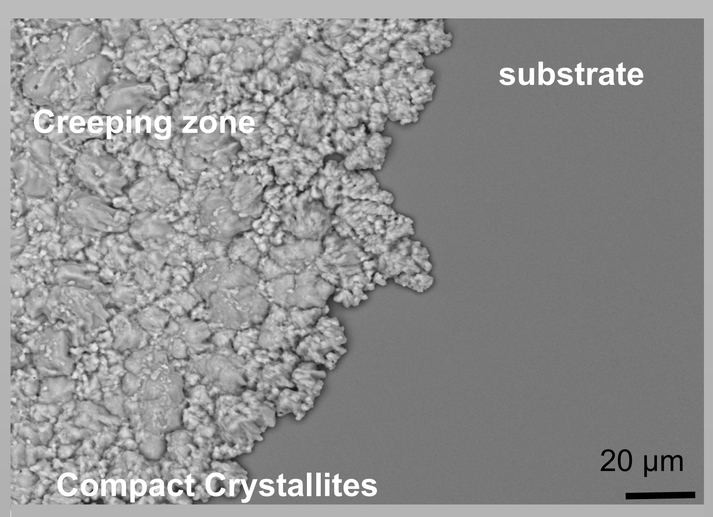
- **New Growth Rate**:

$$\frac{dm}{dt} = \mathrm{A} + \mathrm{B}\, \mathrm{m(t)}$$

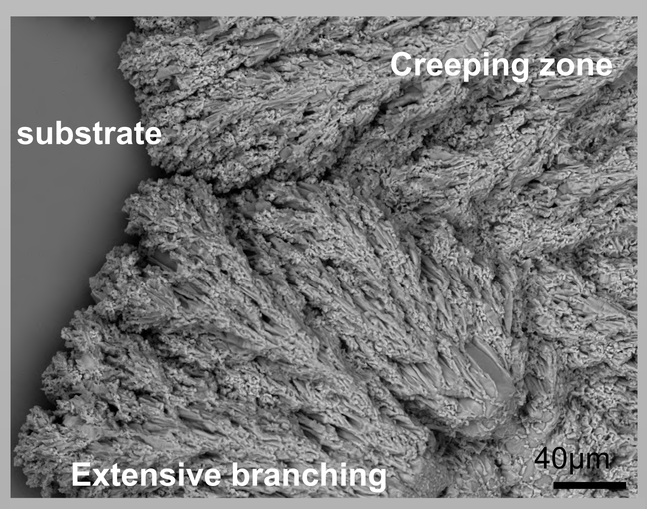
$$m(t) - m(0) = C + \frac{A}{B}(e^{Bt})$$

Evolution of Mass

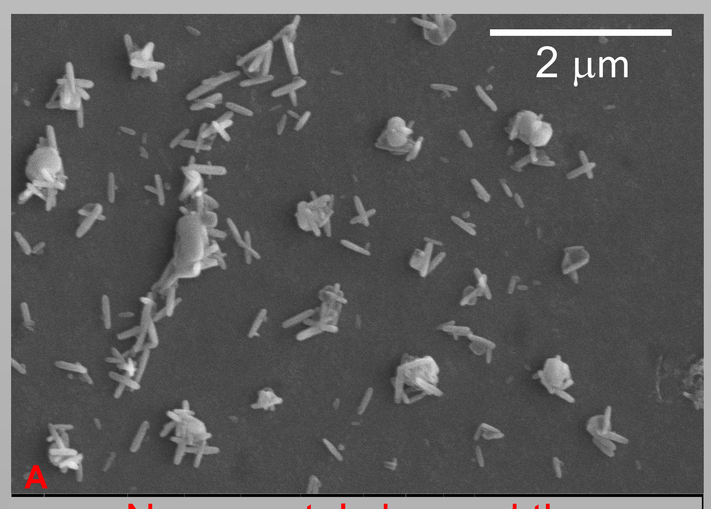




Pure NaCl Solution



NaCl + CTAB Solution



Nanocrystals beyond the creeping line

Conclusion

A.For creeping critical contact angle and multiple nucleation is crucial.
- Critical contact ranges from 20-25 degrees.
- Low relative humidity is important because it enables formation of multiple nuclei which is further enhanced by nucleation promoters and inhibited by nucleation inhibitors.
- The surfactants, CTAB and Tween 80, act mainly as crystallisation modifiers rather than wetting agents.

B.Creeping is a self-amplifying process leading to an exponential increase.