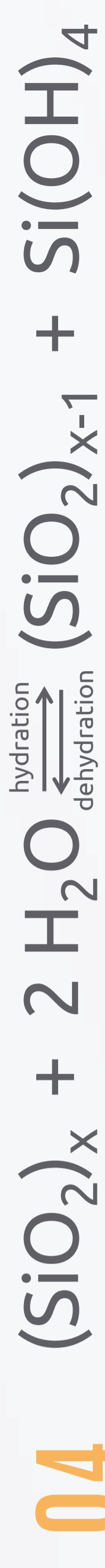


Silica fouling during CSG produced water treatment by RO membranes

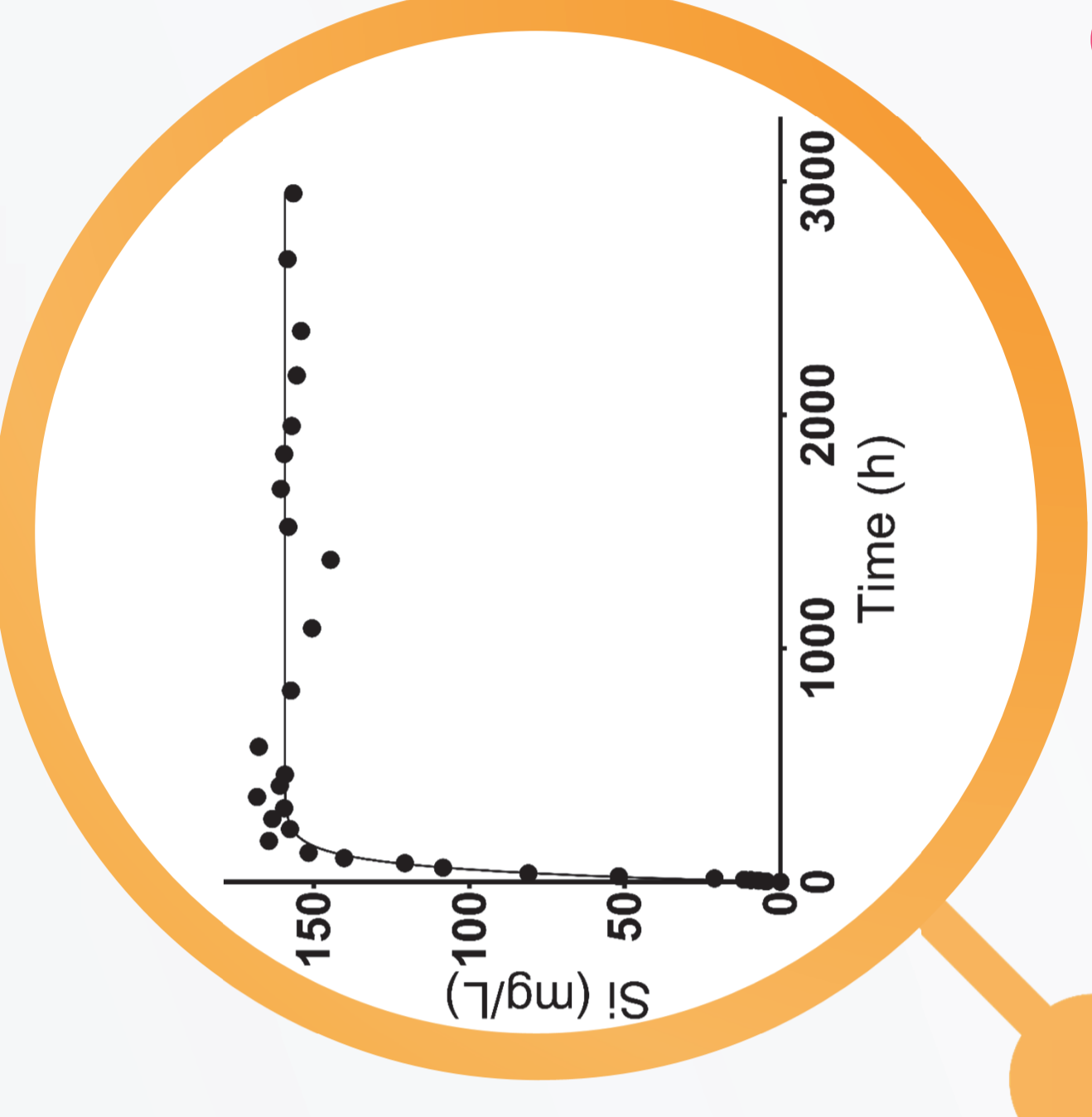
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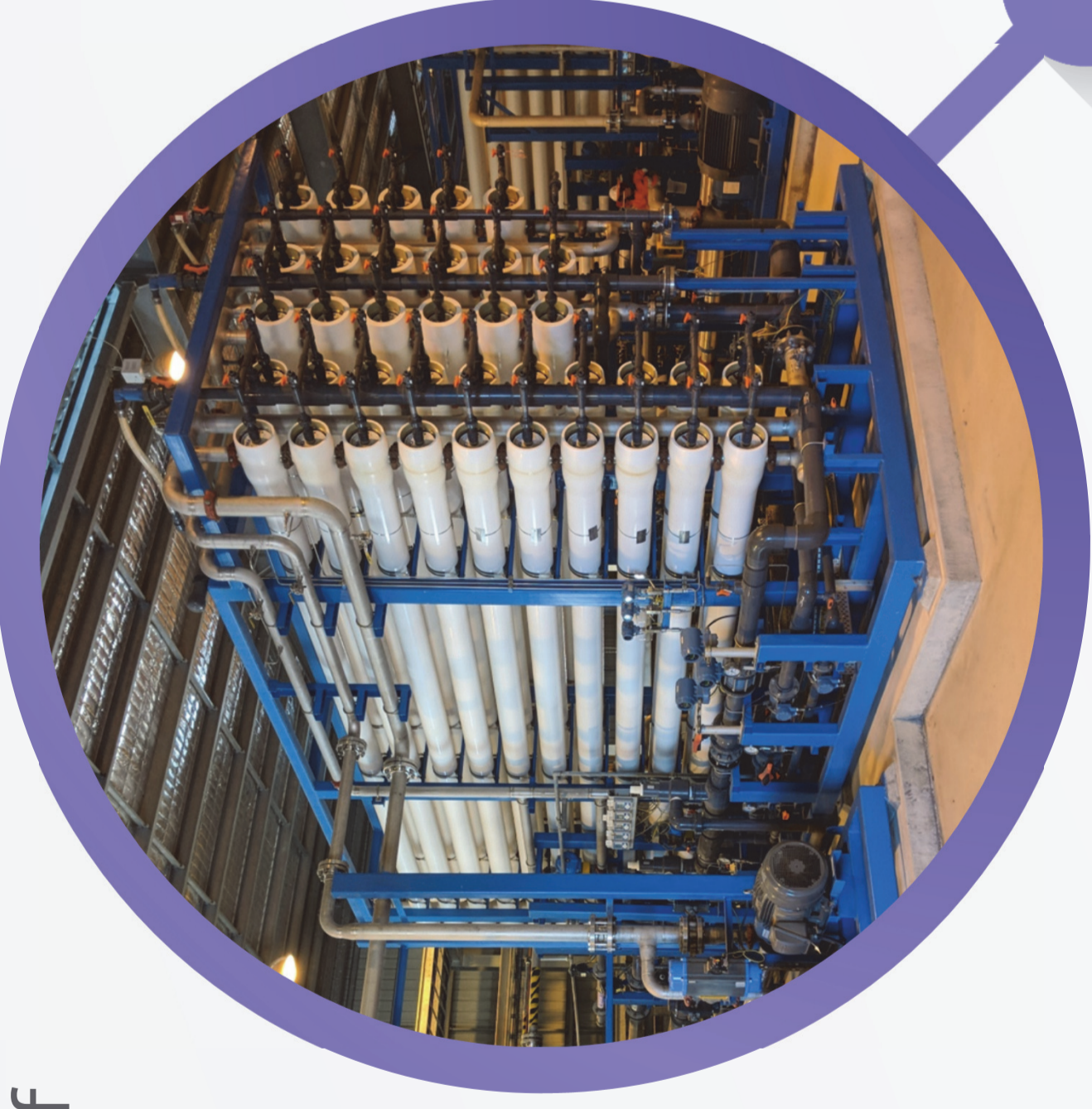
Dissolution



Silica exists in a continuous exchange between its solid and solubilised forms. Dissolution experiments allow study of:

- Rate of dissolution, polymerisation and equilibrium concentration
- Impact of surface area and particle size
- Water chemistry relevant to CSG produced water RO treatment

01 CSG Produced Water



Coal seam gas generates significant volumes of saline produced water requiring treatment by reverse osmosis before it can be put to beneficial use.

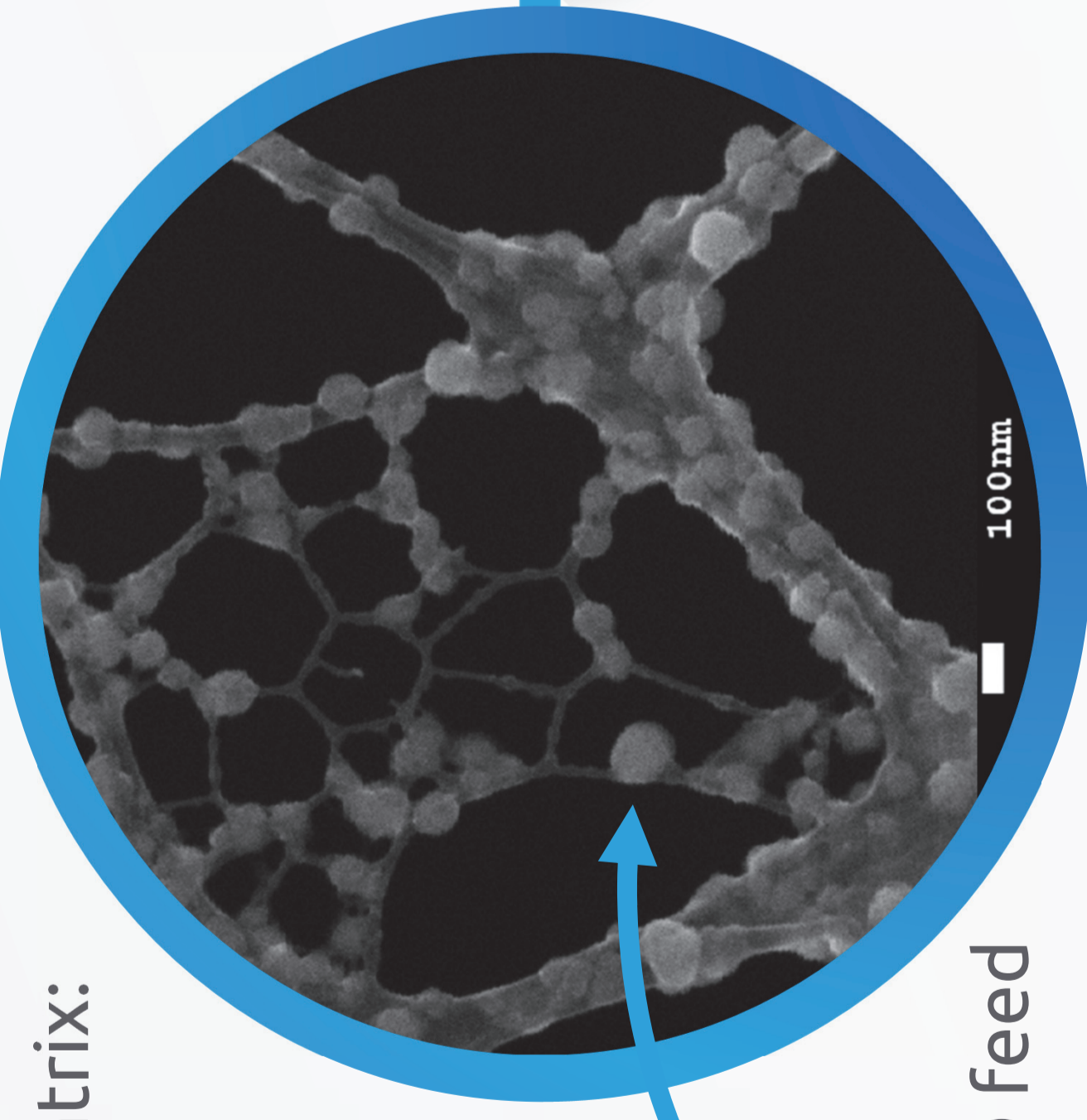
- Queensland CSG peak water projected around >80 GL/yr
- Reduce volume of concentrated brine and costs
- Silica fouling is extremely difficult to remove, requiring harsh cleaning agents

Aim: to better understand the mechanisms contributing to silica fouling and potential management strategies

02 Water Chemistry

CSG water is a complex matrix:

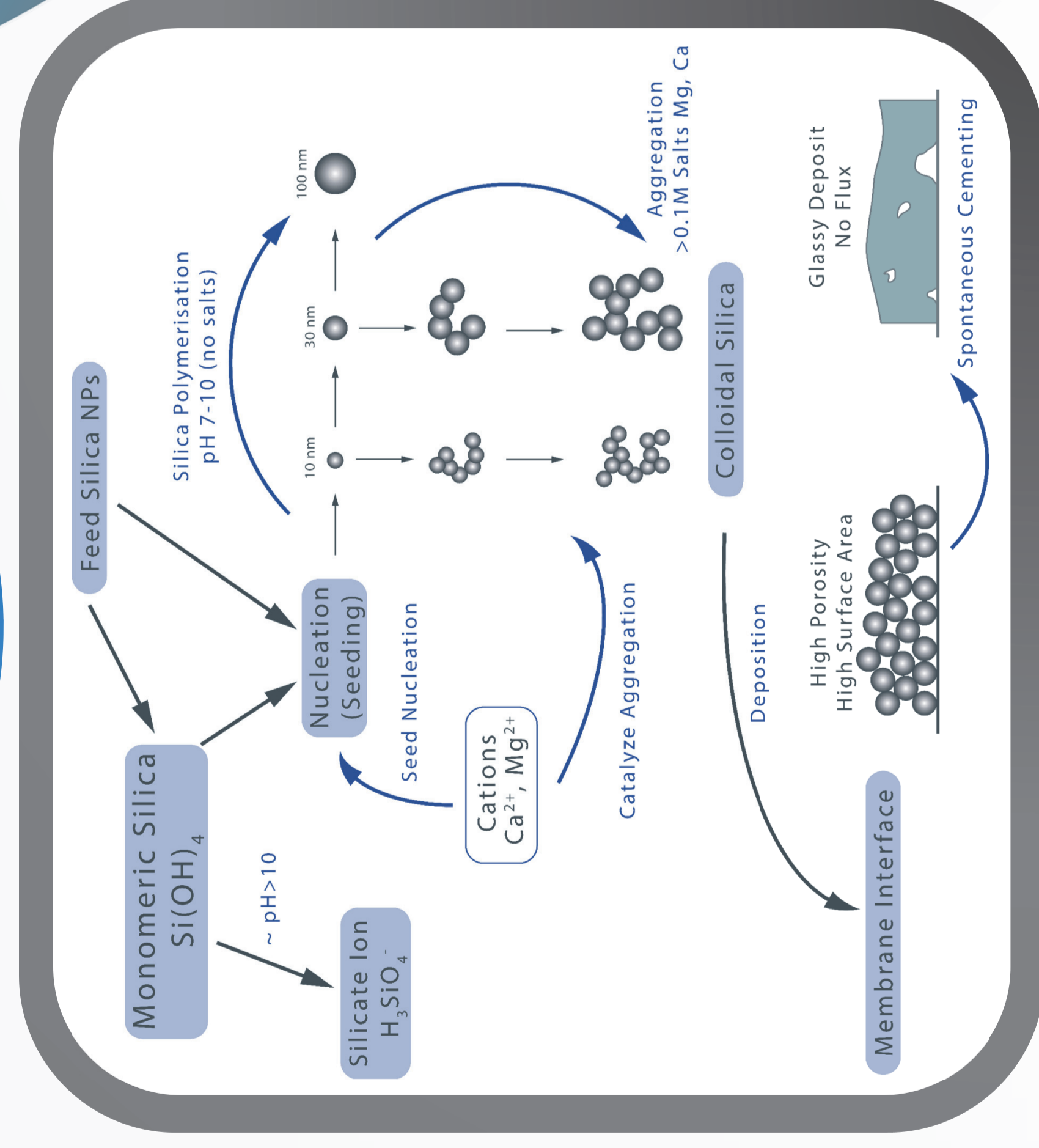
- Dissolved and colloidal silica/silicates
- Salts
- Alkalinity
- Organics



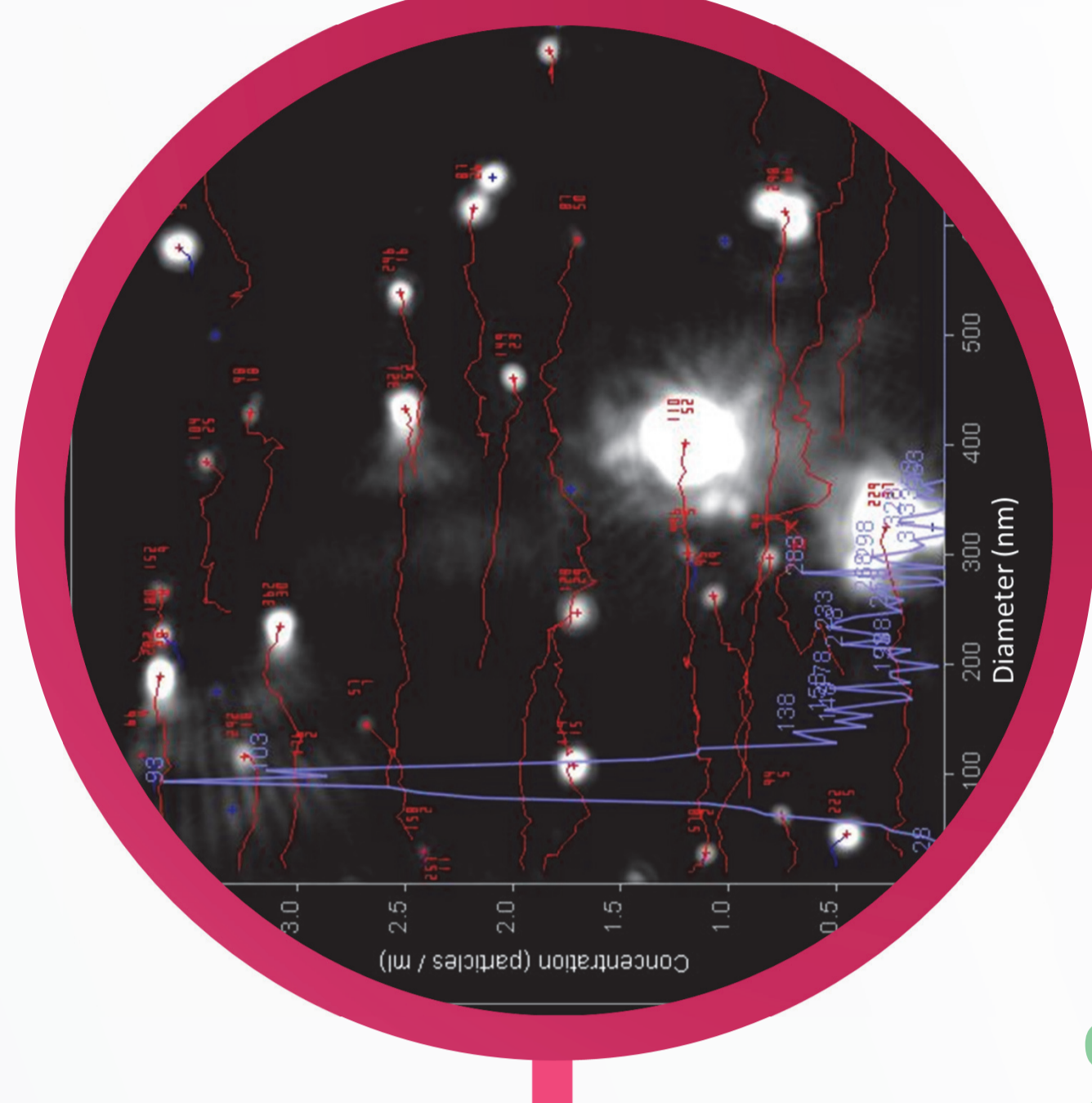
Silica nanoparticles in RO feed

03 Mechanisms

This flowchart summarises the complex interactions and reactions of silica identified in the literature.

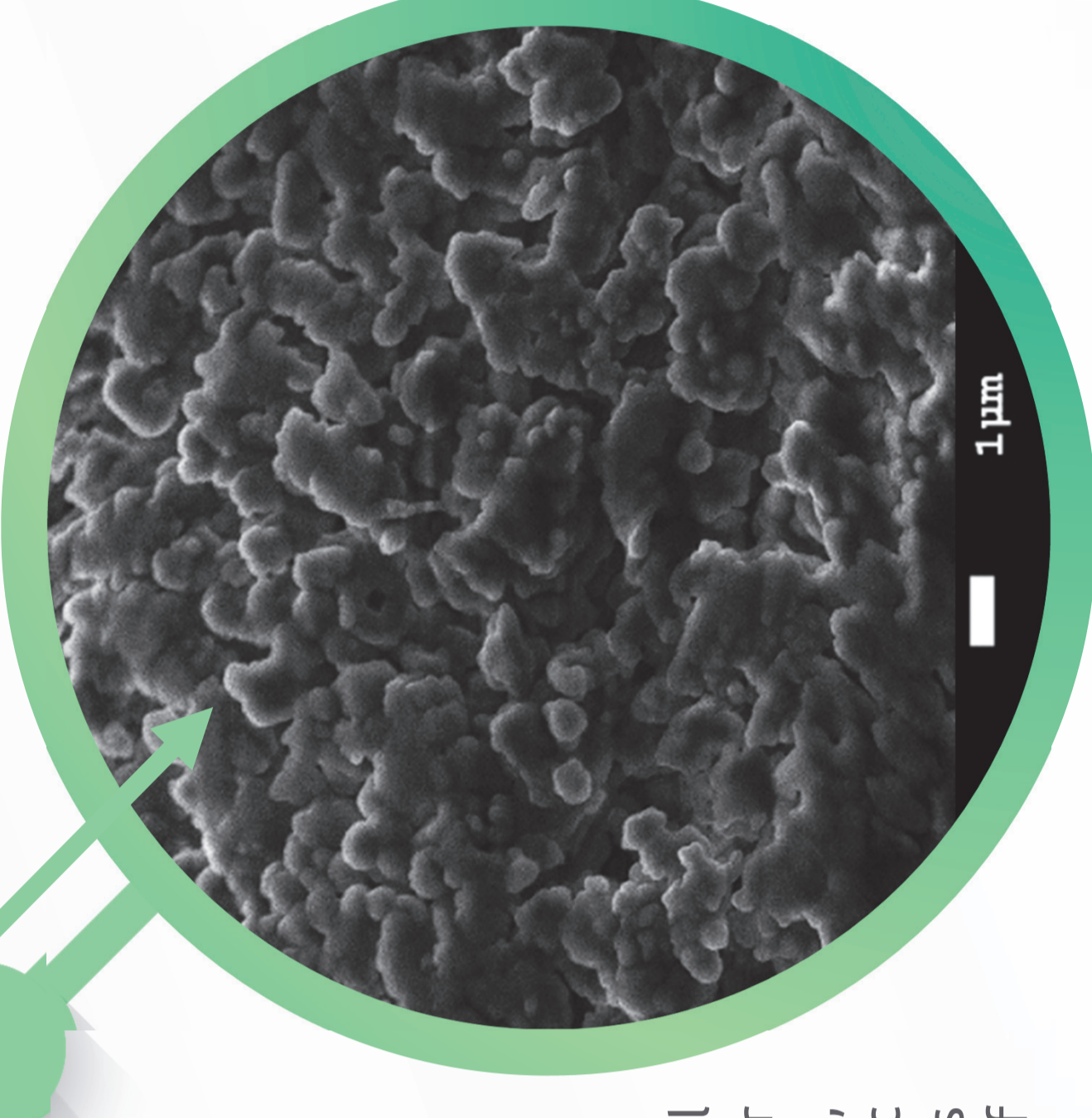


05 Particle Characterisation



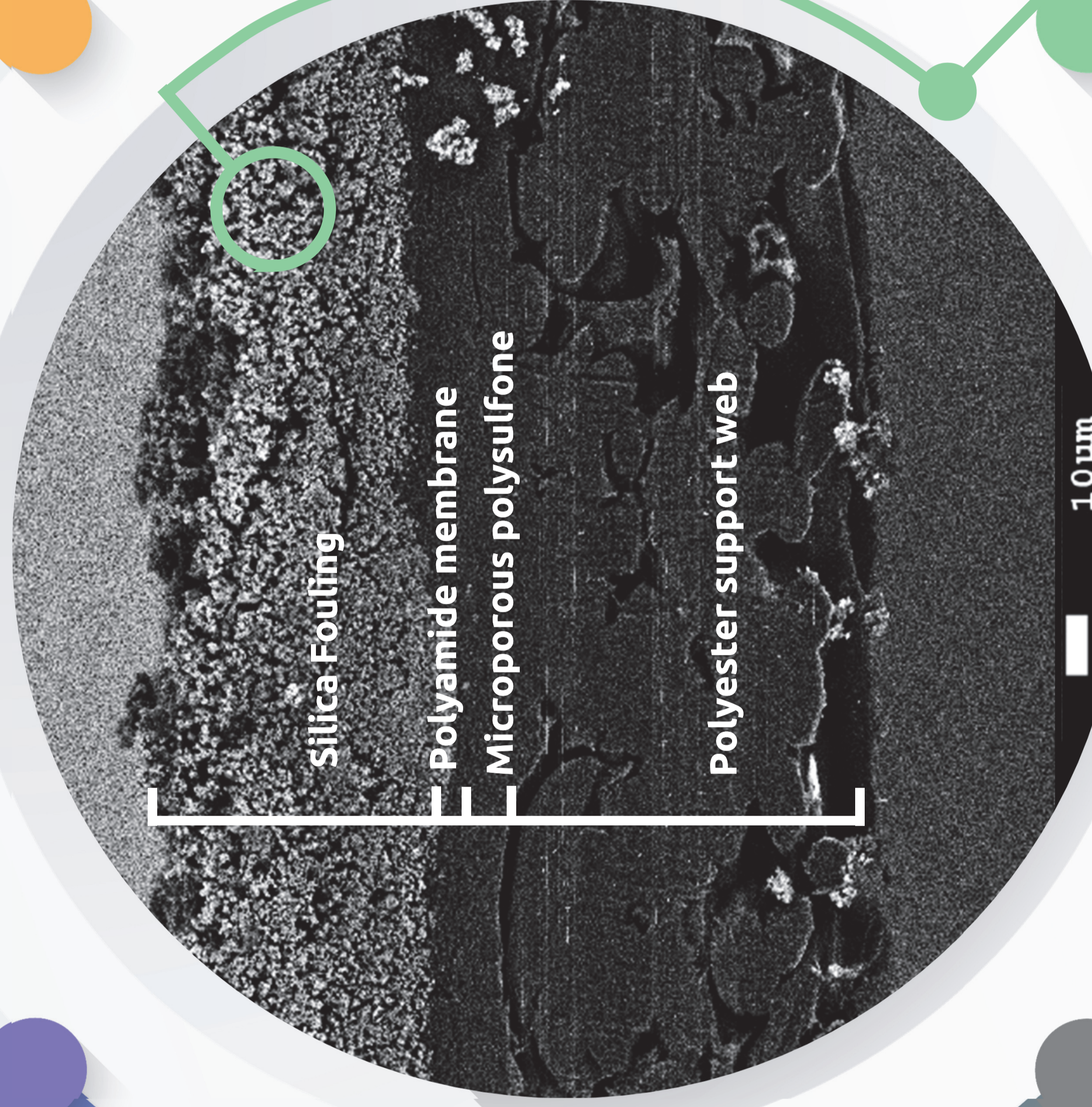
- NanoSight NS300 – individual nanoparticle tracking analysis
- Minimally impacted by background water matrix
- Visual detection of aggregate formation
- Electron Microscopy
- Silica nanoparticle trapping on TEM grids

06 Glassy or Particulate?



- Understanding the behaviour of silica fouling, particularly the formation of glassy deposits, can help improve reliability, and reduce operating costs
- How do operating conditions contribute to silica fouling?
 - Is the formation of glassy deposits preventable?

Silica fouling is commonly observed as a particulate layer, or in some cases a glassy, cement-like deposit.



SEM (backscattered electrons) cross section of a silica fouled RO membrane

Acknowledgments

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