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Rachid Belhadi, Philippe Grosseau, Alexandre Govin

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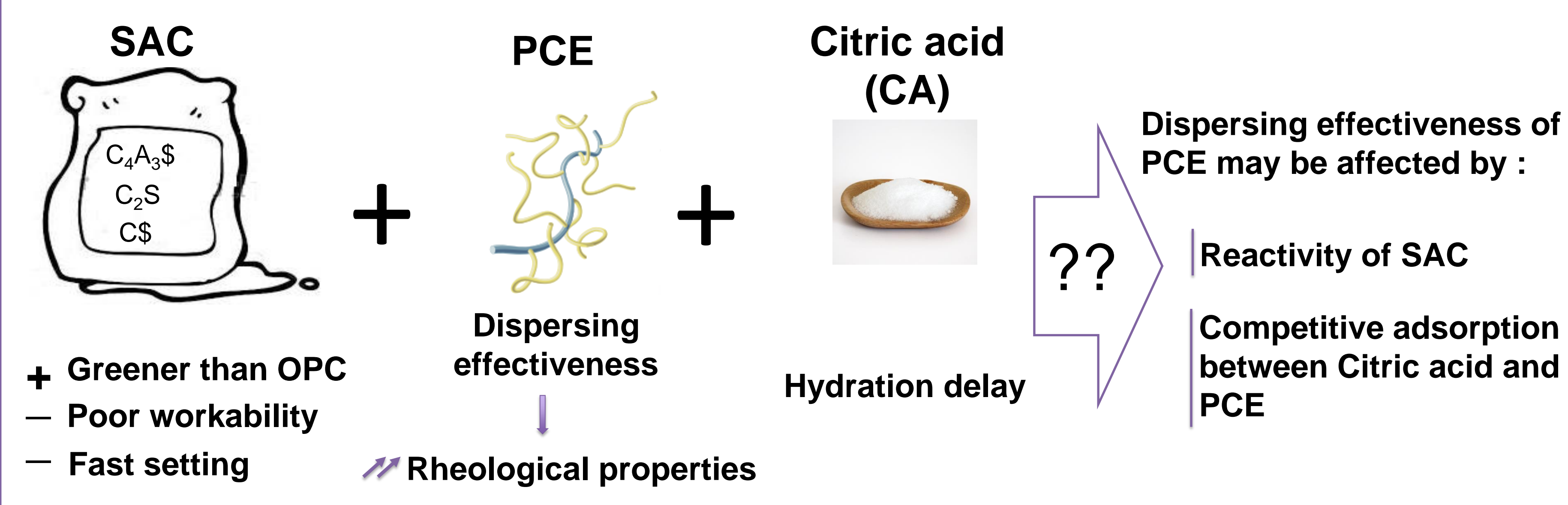
Hydration and rheology of sulfoaluminate-belite cements (SAC) in presence of polycarboxylate superplasticizers (PCE) and citric acid

R. Belhadi*, A. Govin & P. Grosseau

Mines Saint-Etienne, Univ Lyon, CNRS UMR 5307 LGF, Centre SPIN, Departement PMMG, F - 42023 Saint-Etienne France

* rachid.belhadi@emse.fr

1. Context

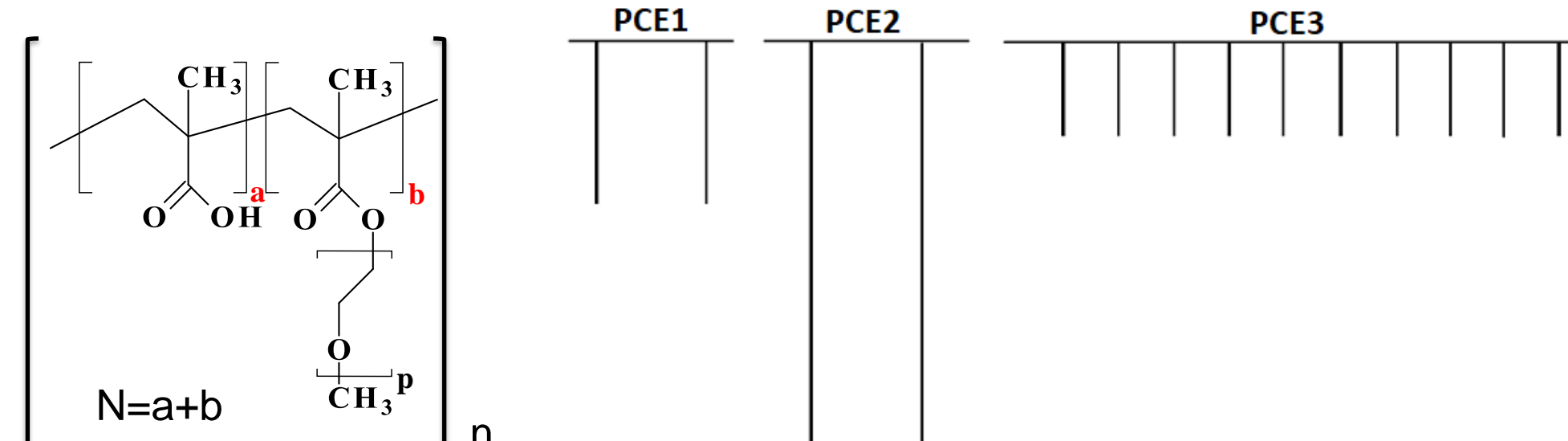


3. Materials

- Commercial SAC (i.tech ALI CEM)
- Citric acid (99,5% Honeywell)
- 3 polycarboxylates ethers (PCE1, PCE2 and PCE3)

Phase composition of SAC (%)	C ₄ A ₃ \$	C ₂ S	C\$
	49,3	15,1	23,5

	Mw (g/mol)	Charge density (mmol/g)	P	N	n
PCE1	48300	0,79	45	5	12
PCE2	138600	0,3	114	5	15
PCE3	11900	0,96	17	2,5	115

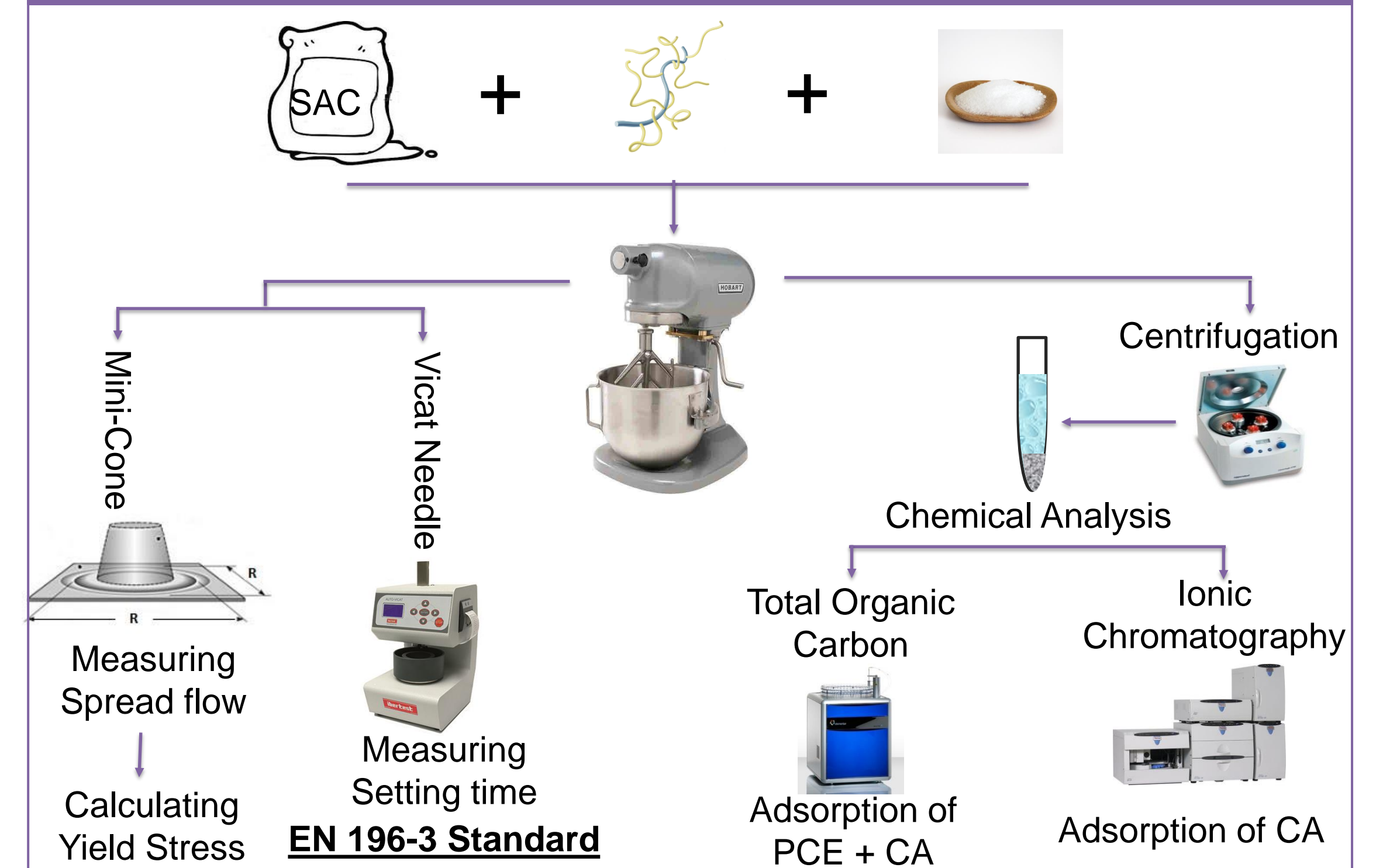


2. Objectives

Understand the :

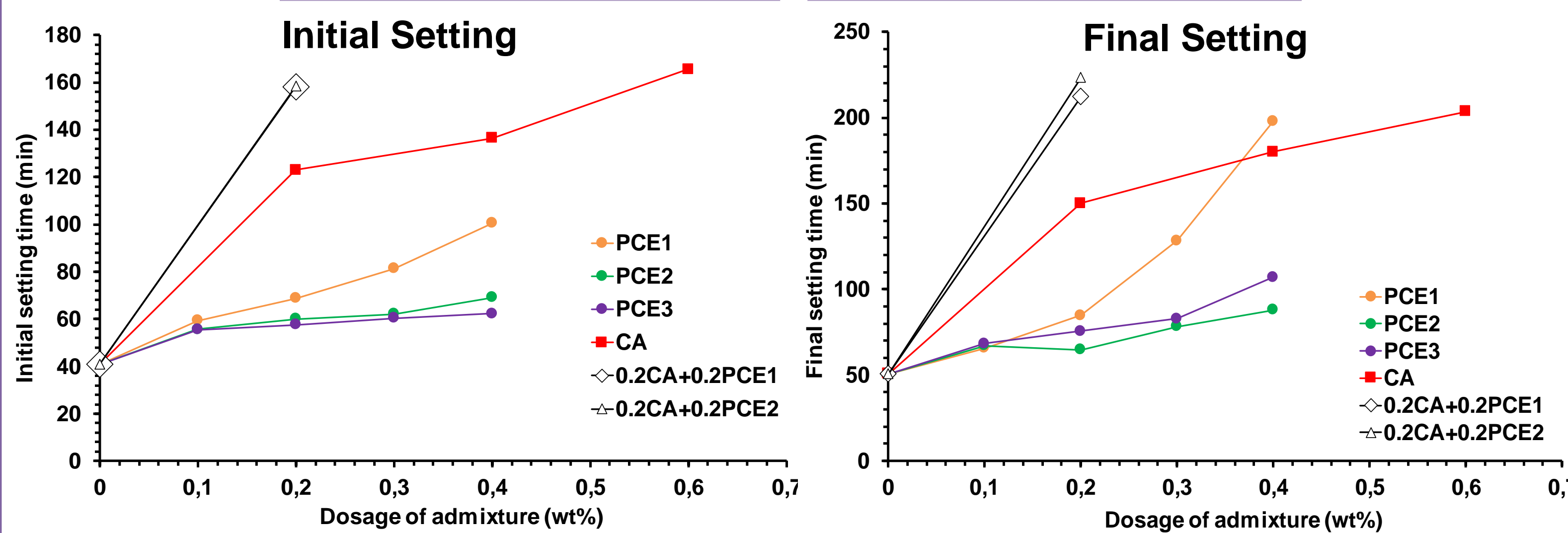
- Effect of the chemical structure of PCE on the hydration and rheology of reactive SAC
- Effect of combination of citric acid with PCE on hydration and rheology of reactive SAC

4. Methods

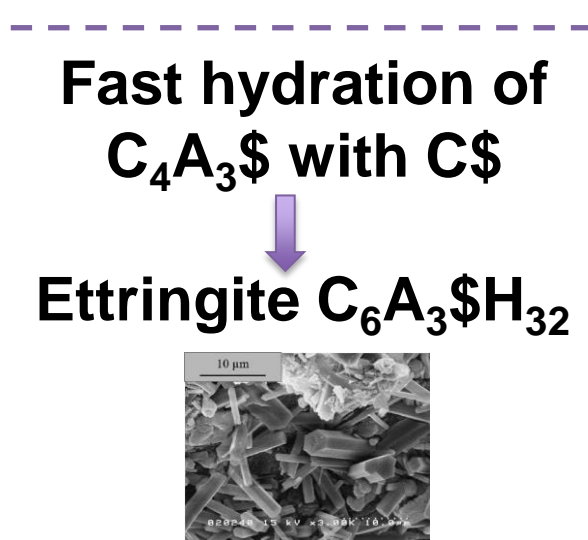


5. Results

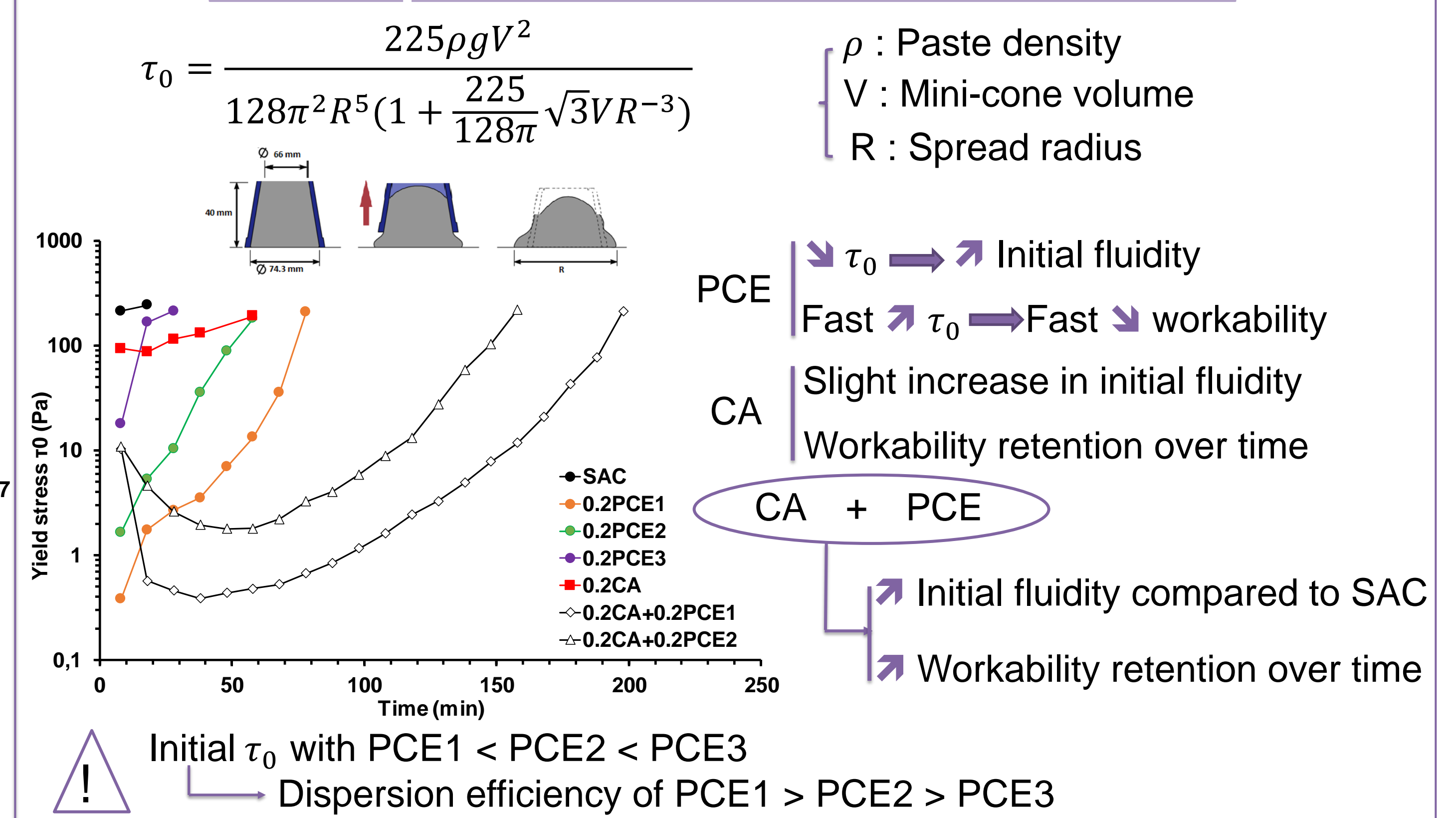
Setting-Time



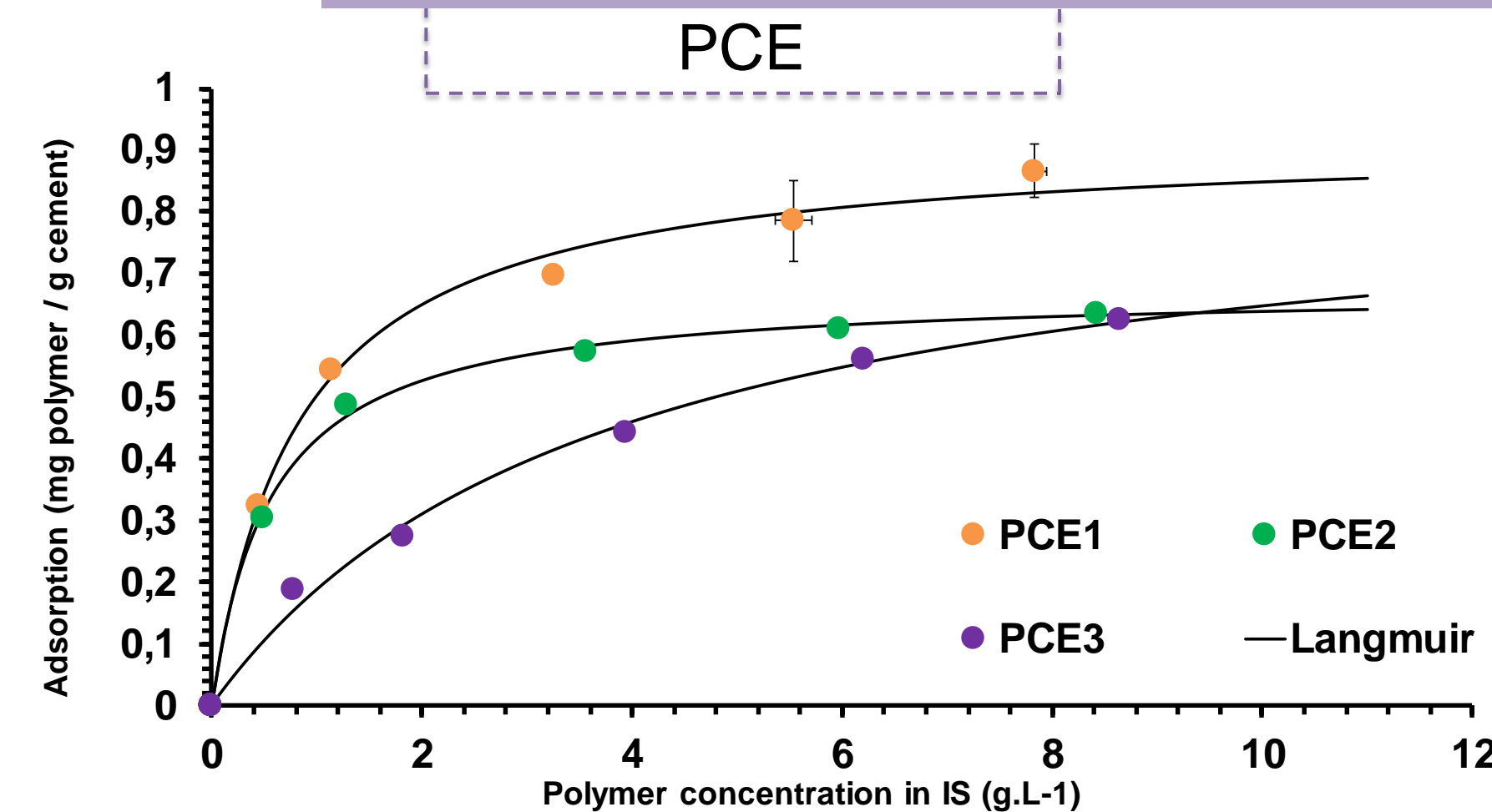
- Short setting time of SAC without admixtures
- CA delays significantly the Initial and Final setting times
- % in PCE → Initial & Final setting: PCE1 > PCE2 ≈ PCE3
- PCE + CA → Initial & Final setting: PCE+CA > CA > PCE
- PCE1 + CA ≈ PCE2 + CA



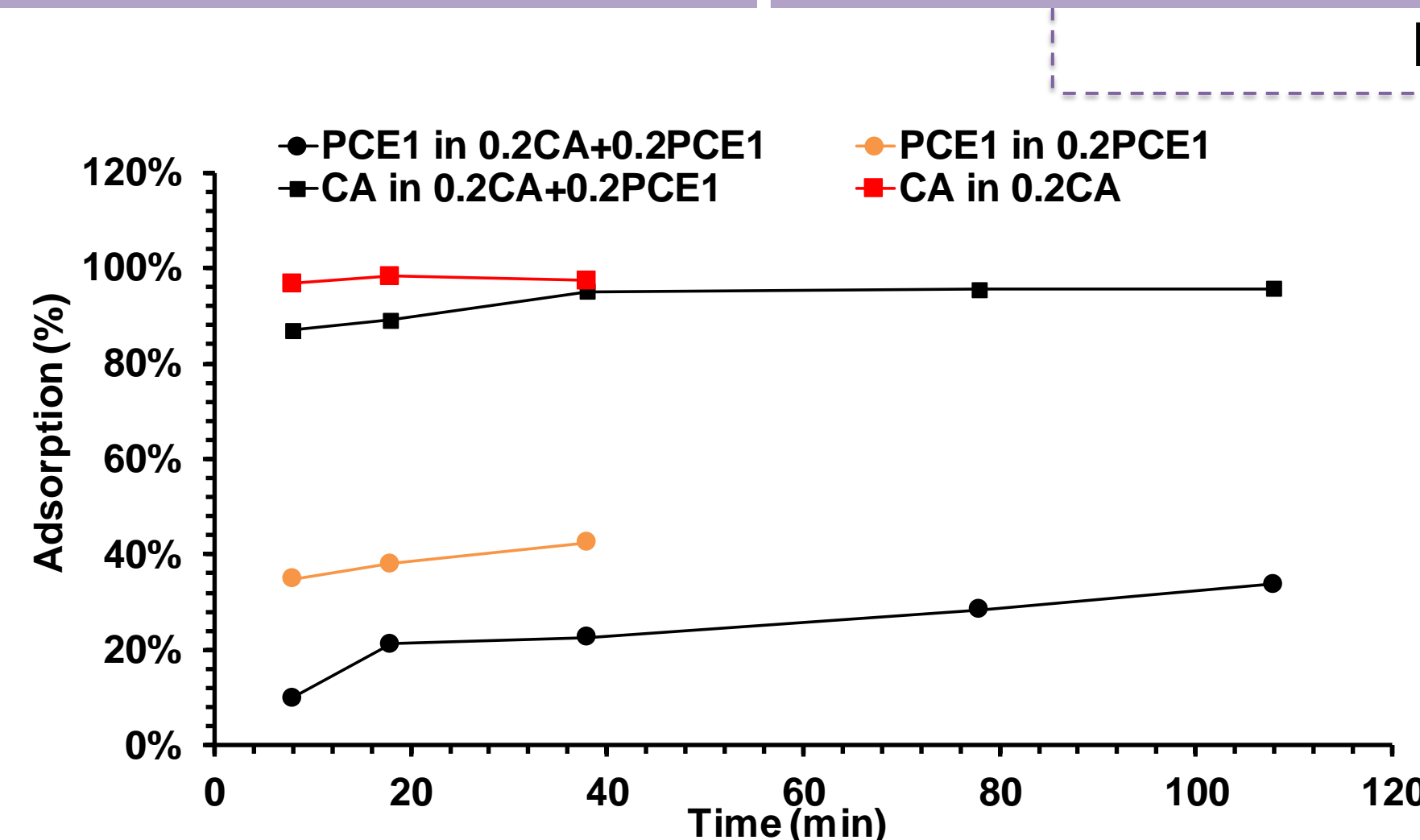
Spread flow / Yield stress



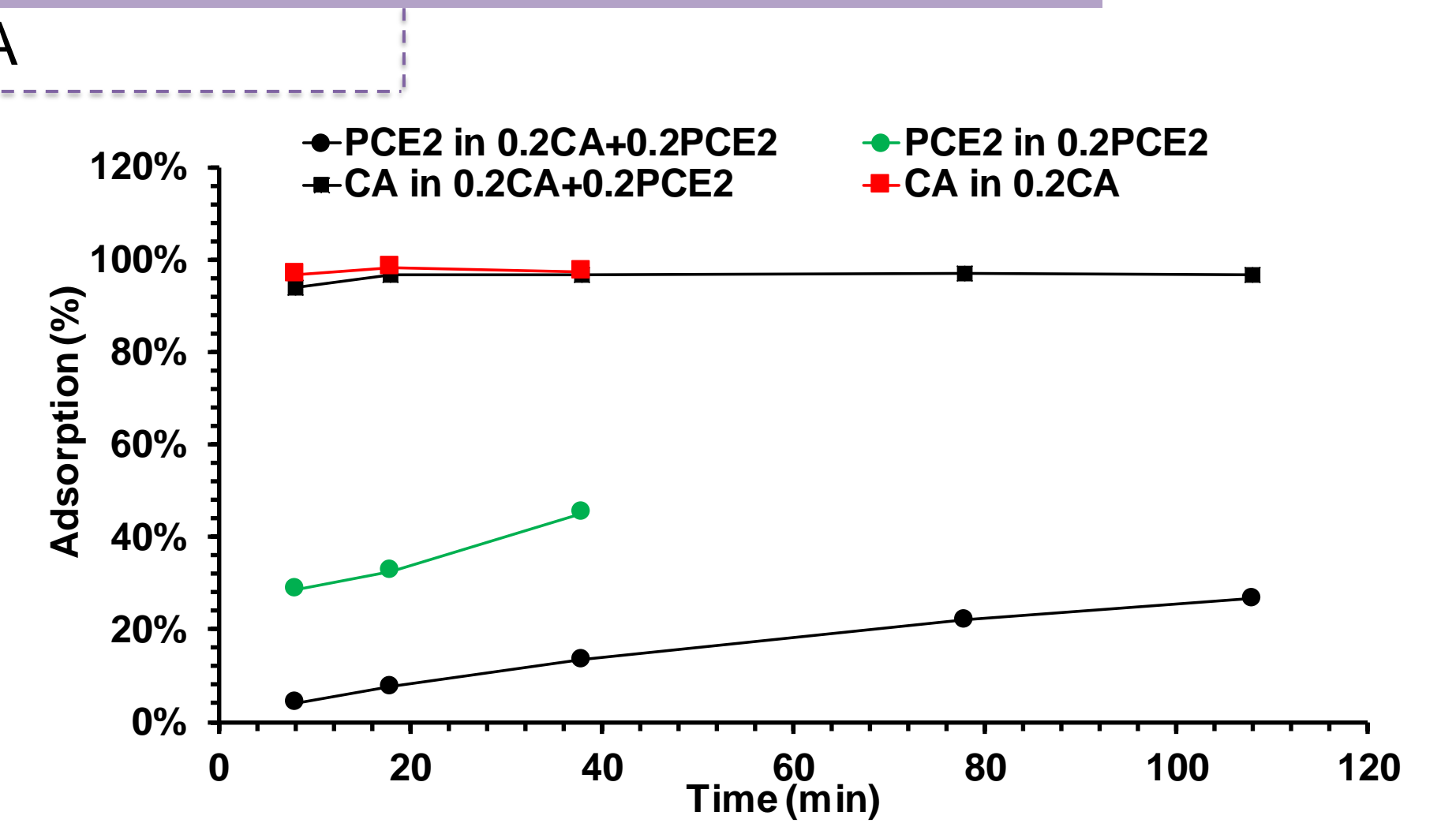
Adsorption



- Affinity of PCE with SAC : PCE1 > PCE2 > PCE3
- Maximum adsorption : PCE1 > PCE3 > PCE2
- Explain the better dispersing efficiency of PCE1
- the lowest dispersing efficiency of PCE3



- Adsorption of CA ↓ from 97% to 87% in presence of PCE1
- The amount of PCE adsorbed decreases in presence of CA
- The amount of PCE adsorbed increases over time



- Initial fluidity compared to PCE alone
- Workability retention over time
- Competitive adsorption

6. Conclusions & Perspectives

PCE	CA	CA + PCE
Setting time : PCE1 > PCE2 ≥ PCE3	Setting time : CA > PCE	Setting time : PCE + CA > CA > PCE
Dispersing effectiveness : PCE1 > PCE2 > PCE3	Adsorption : CA > 97% >> PCE	Adsorption : CA > 87% > PCE & PCE < PCE alone
Adsorption : PCE1 > PCE2 > PCE3		Effect → Initial fluidity compared to PCE alone → Workability retention over time

TGA & DRX are required to follow the hydration

→ Rheological properties

→ The amount of PCE consumed by intercalation

CA reduces the amount of ettringite at early age

Hypothesis