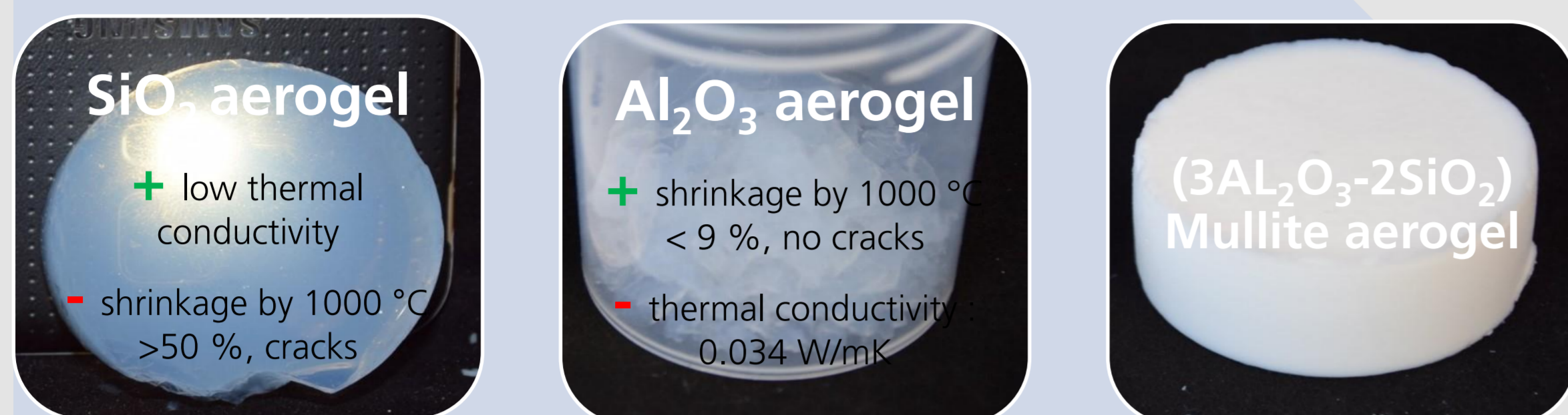


Al₂O₃-SiO₂ Aerogel

New Synthesis Route

Introduction



Al₂O₃-SiO₂ aerogel properties:

- High porosity: 91-94 %
- Low density: 0.01 - 0.20 g cm⁻³
- Shrinkage by (1000 °C) < 9 %, cracks, broken (thermal stability up to 1200 °C)
- Thermal conductivity: not measurable

* photo, aerogel synthesis from the AIC3 route

State-of-the art

Two ways to synthesis aluminum containing aerogels:

- hydrolysis of aluminum tri-sec-butoxide using acetone and aniline to release water in a defined manner. Aniline is toxic and carcinogenic.
- The salt route is working with aluminium chloride, carcinogenic propylene oxide as proton scavenger to control gelation.



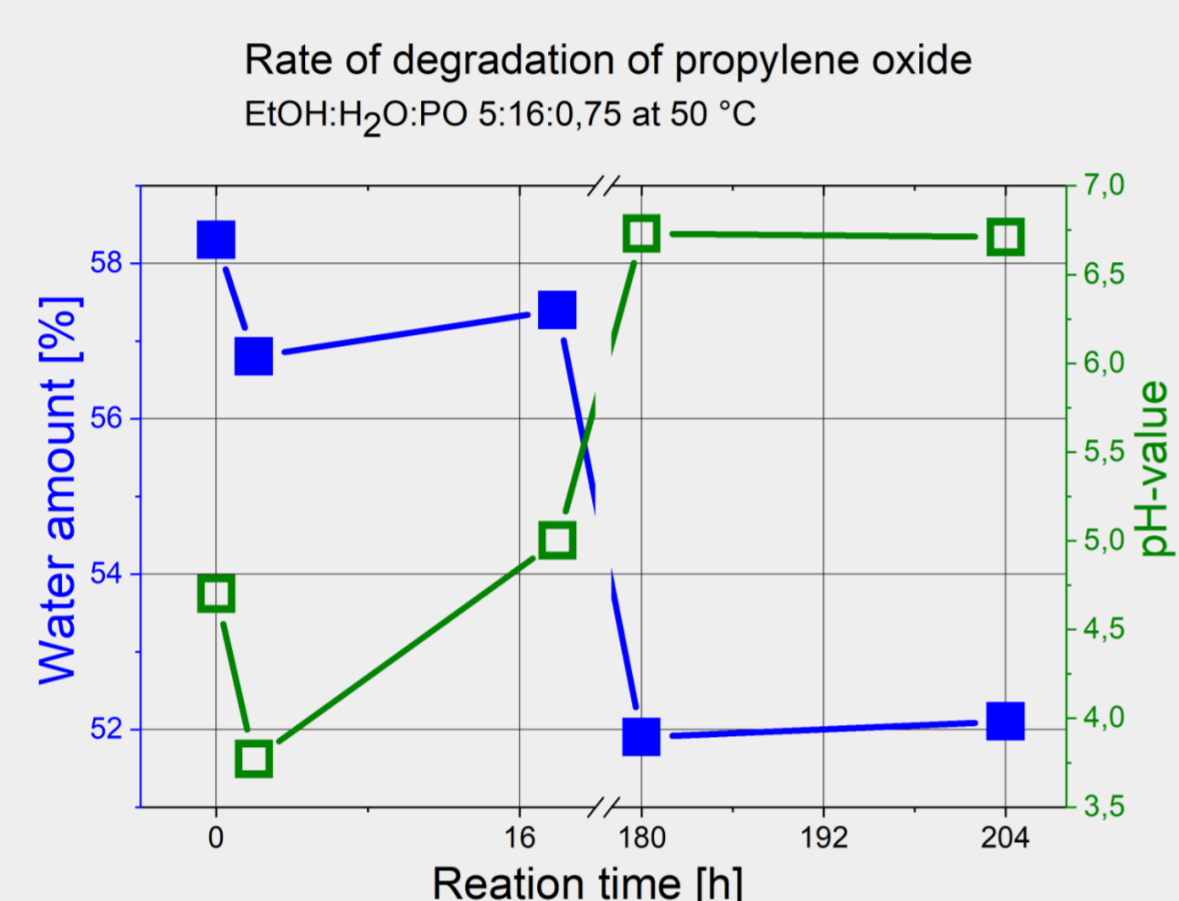
New developed route

- In this poster the substitution process of propylene oxide will be shown



Theory

Gelation Initiator



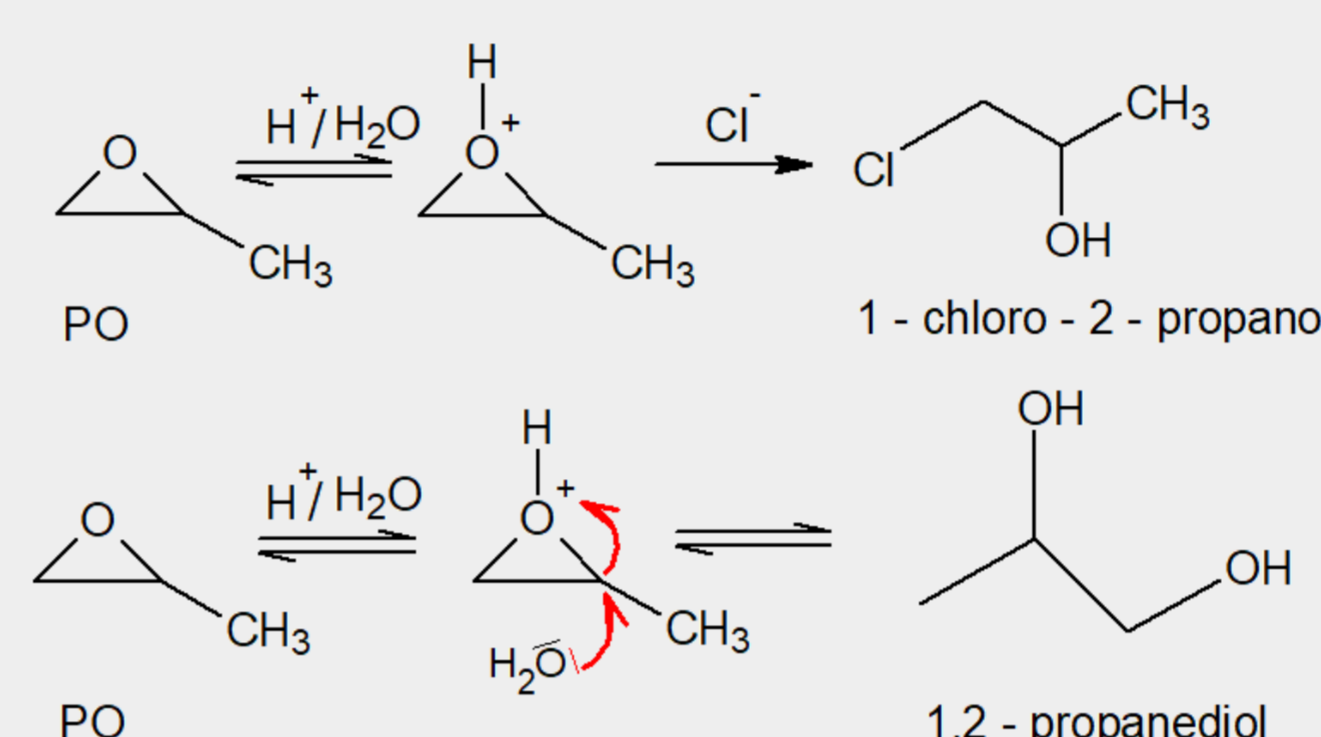
Propylene oxide is the gelation initiator:

- Protonation increases the pH-value
- Water amount decreases

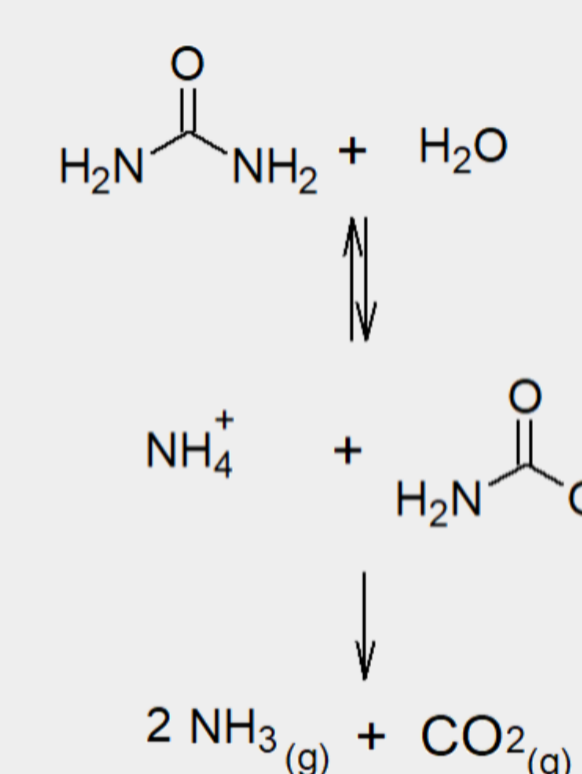
→ Gelation starts

Urea can be used in the same way.

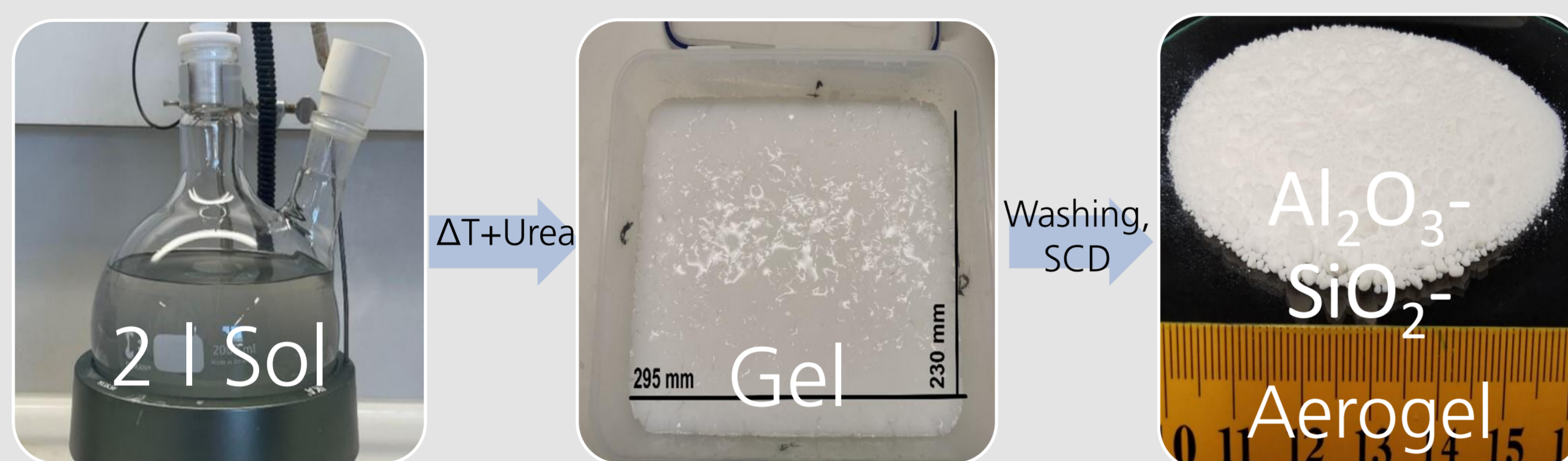
Propylene Oxide



Substitution with Urea



Alternative Synthesis Route



Advantages

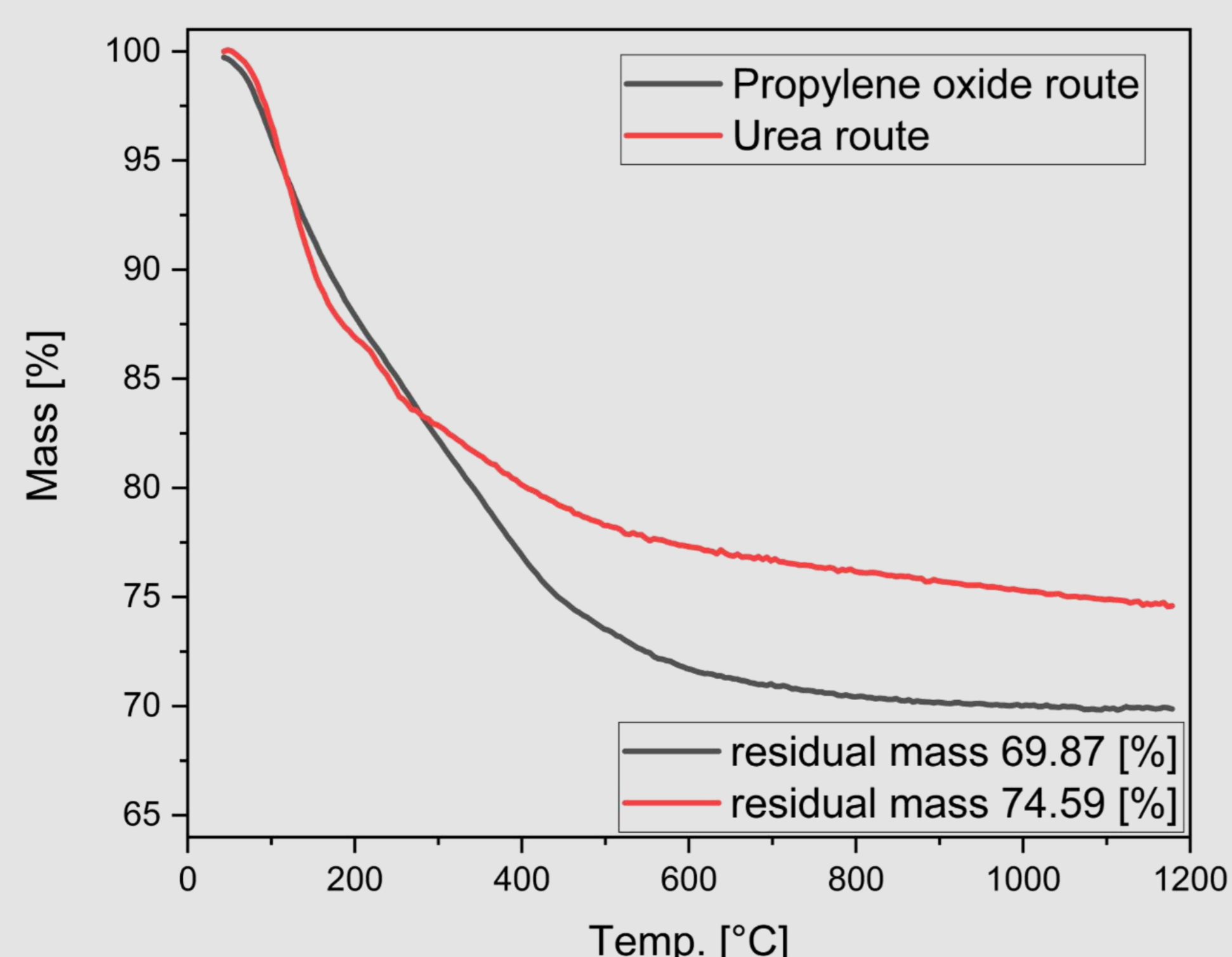
- No carcinogenic or toxic chemicals in educts and products
- Scalability depends on the oven or heating bath size
- Theoretically high temperature resistance up to mullite species
- Washing products are not hazardous waste
- Other salt precursor for example ZrCl₂ can easily be added to the synthesis

Disadvantages

- Around ten washing steps are needed before the gel is prepared for the super critical drying
- Higher shrinkage after temperature treatment for the urea synthesis route compared to the propylene oxide route

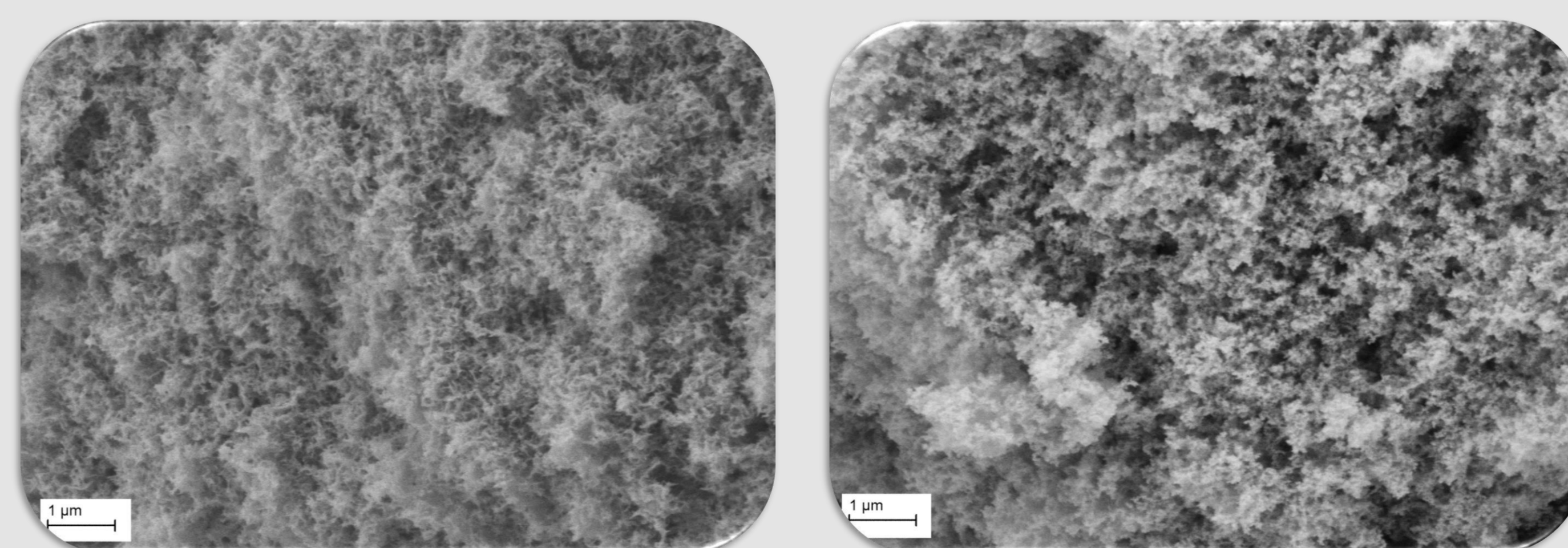
Results & Discussion

Analysis and Comparison

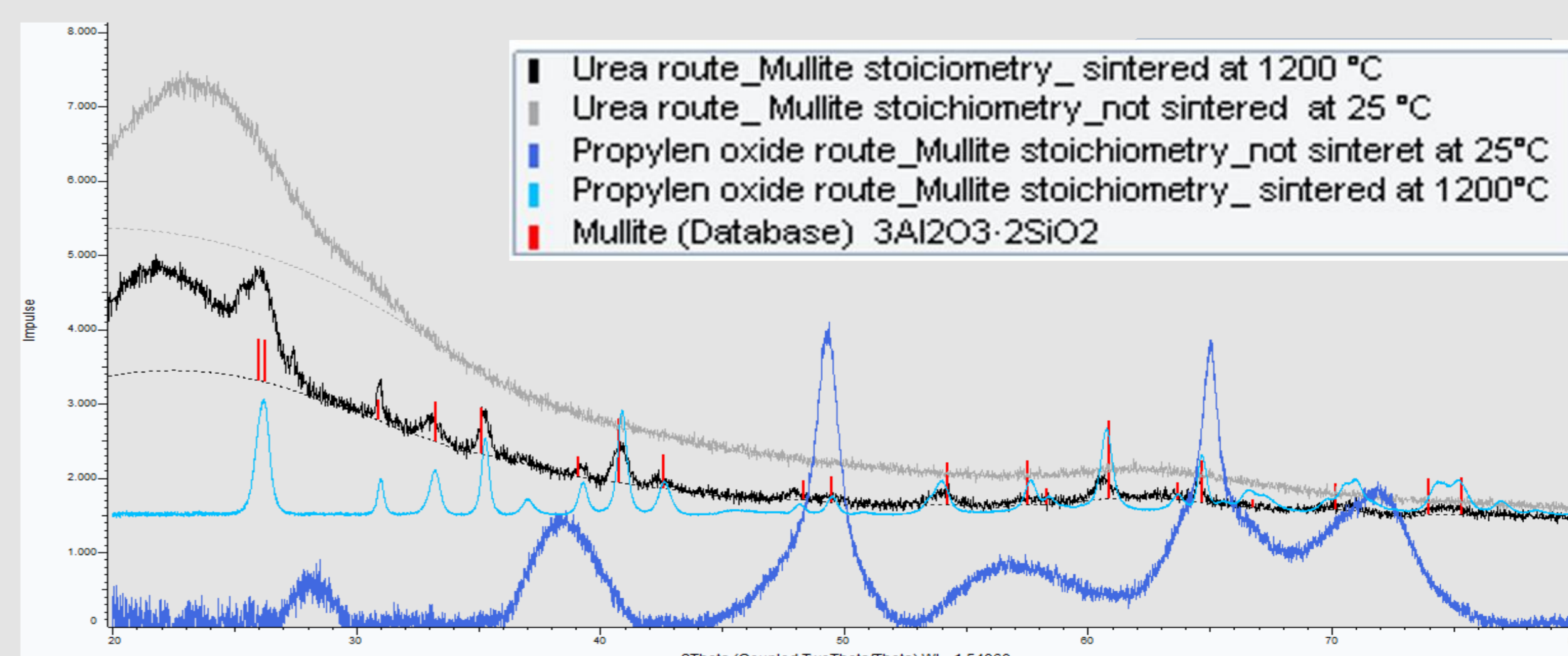


Future steps

- Improving washing steps, lower shrinkage, faster washing process
- Completely analyzing of aerogel to improve temperature stability
- Reaching temperature stability of the propylene oxide route



SEM: Inner structure of Al₂O₃-SiO₂ aerogels: via propylene oxide route, left; via urea route, right.



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