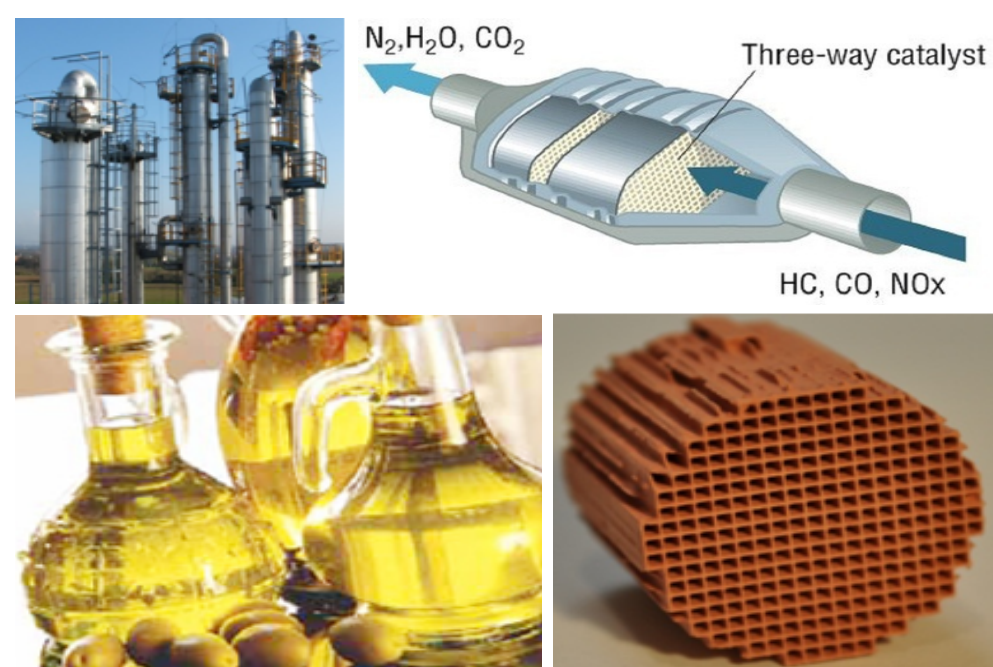


Tailoring the Physiochemical Properties of SSZ-13 Zeolite with Polyquat Growth Modifiers

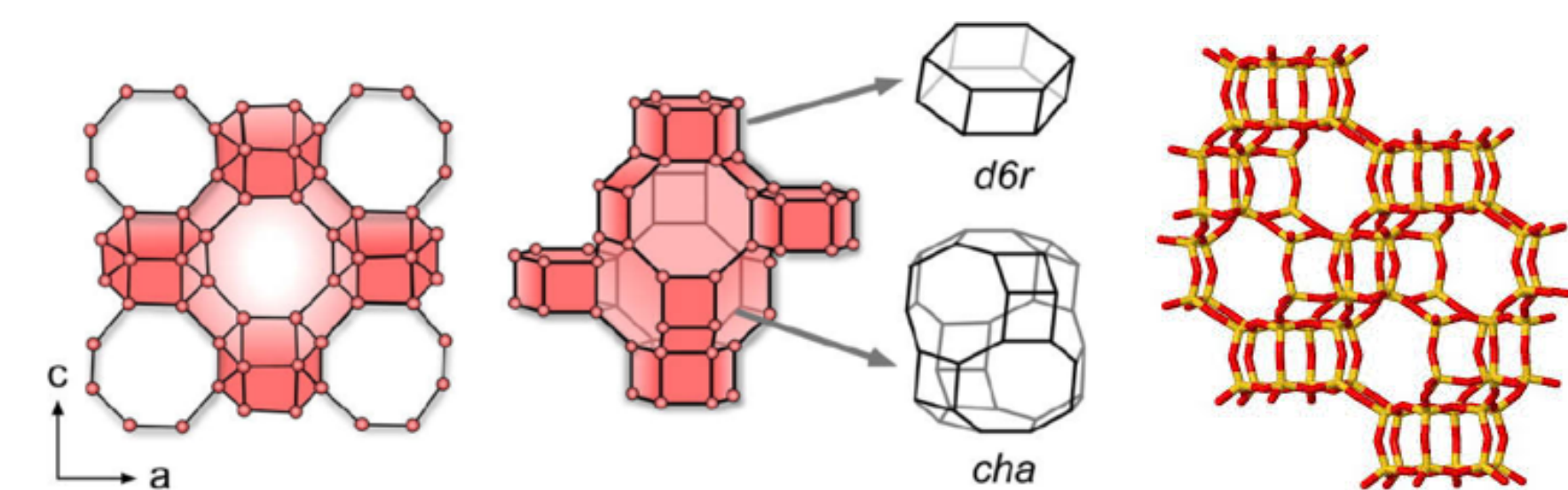
UNIVERSITY of
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Jakob Claret, Heng Dai, and Jeffrey D. Rimer
University of Houston, Department of Chemical & Biomolecular Engineering,
4800 Calhoun Rd, Houston, TX 77204

Background

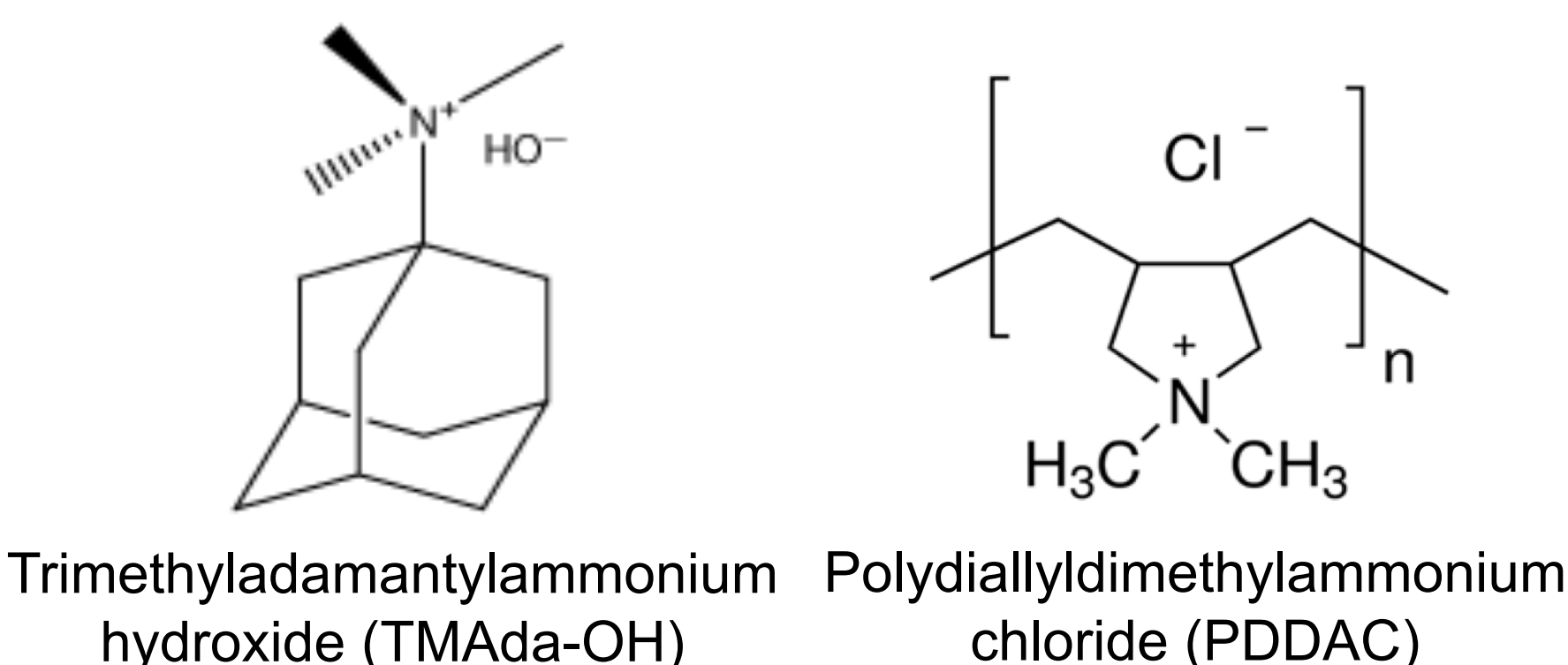


- Zeolite = 'boiling stone' in ancient Greek
- Crystalline aluminosilicate materials
- Widely used for catalysis, adsorbates and emission control



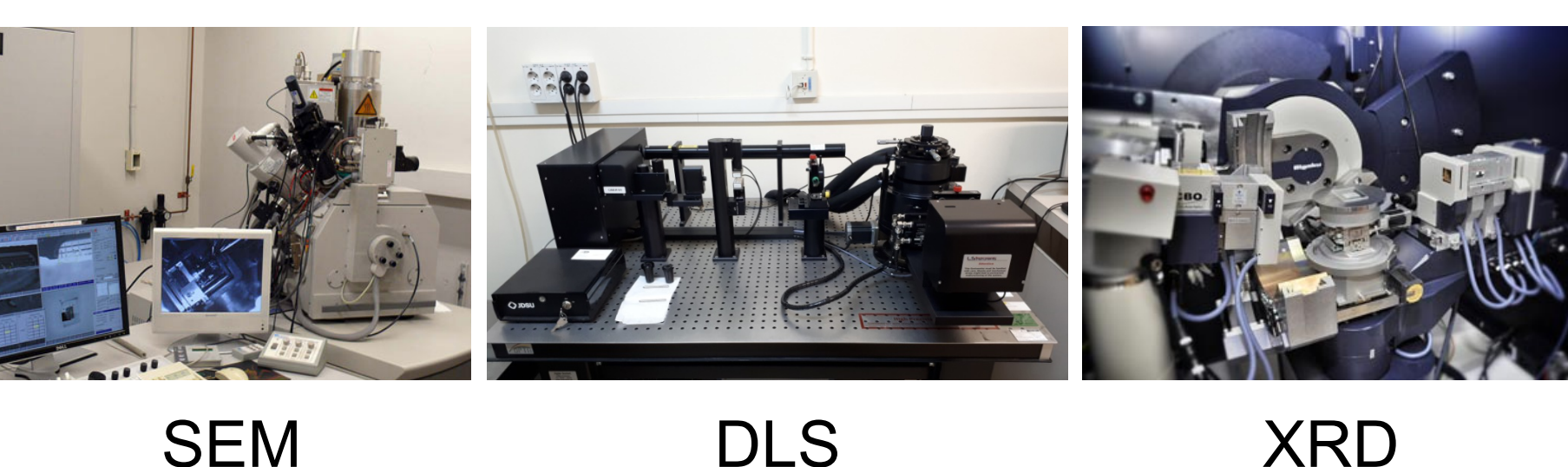
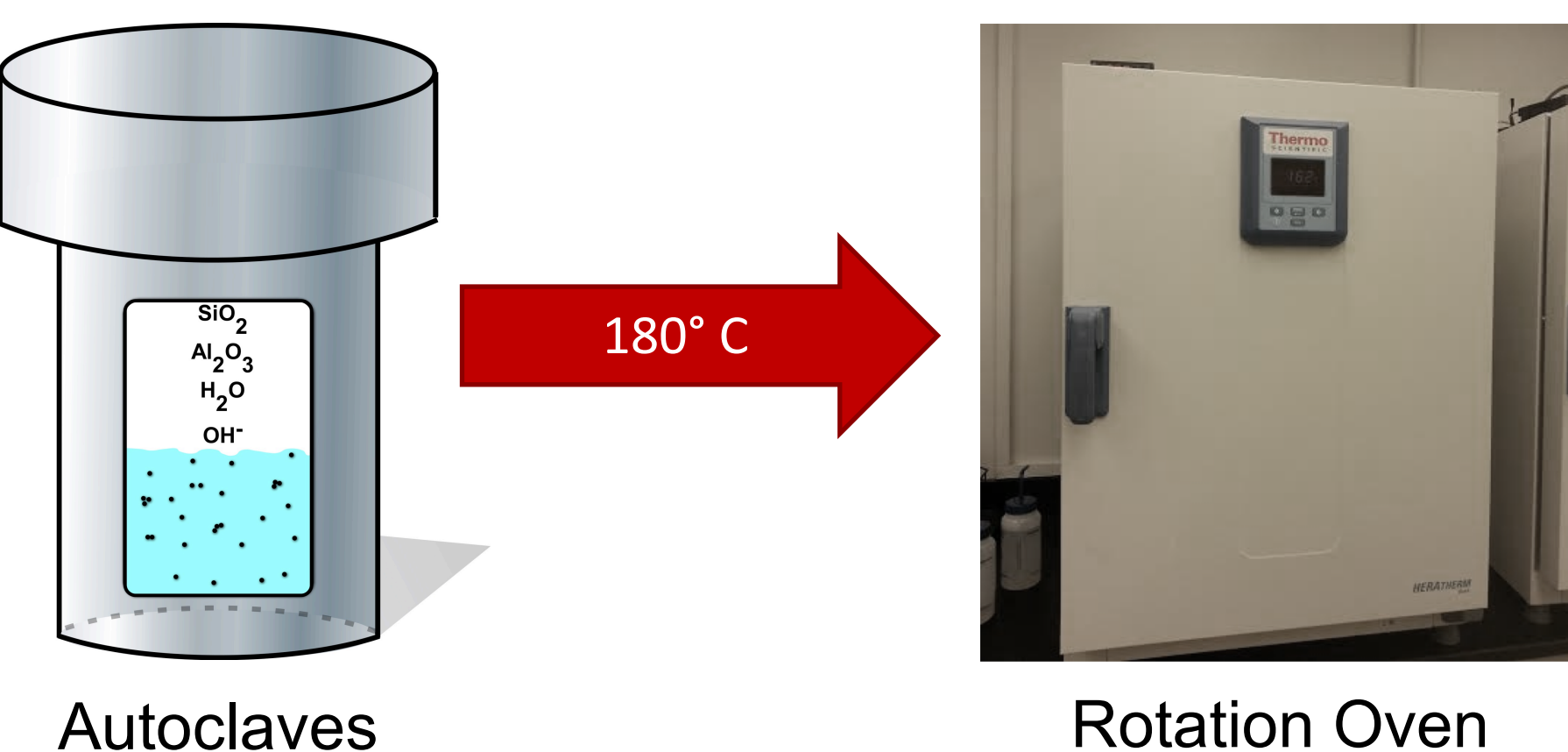
Kumar et al. *J. Am. Chem. Soc.* 2015.

- SSZ-13 (chabazite framework) consists of six membered rings of tetrahedral silica and alumina combined into supercages
- Commonly synthesized using TMAda-OH as the organic structure-directing agent (OSDA)
- Charged quaternary amines (e.g. PDDAC) promote crystal growth in addition to the OSDA

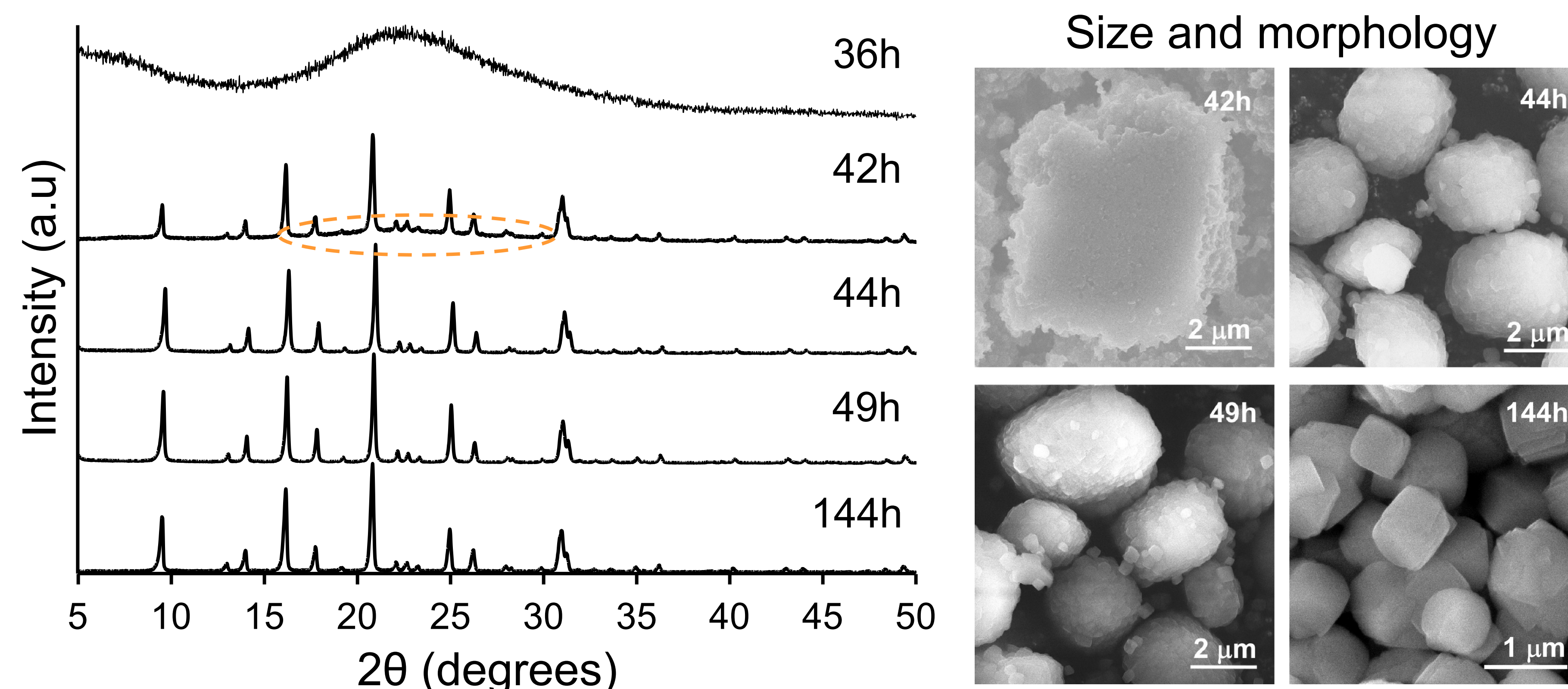


Experimental Methods

- Typical zeolite synthesis:
 - Mixing and aging the reactants
 - Hydrothermal synthesis with rotation
- Powder X-ray diffraction analysis (XRD)
- Scanning electron microscopy (SEM)
- Elemental analysis: electron dispersive spectroscopy (EDS)
- Dynamic light scattering (DLS)

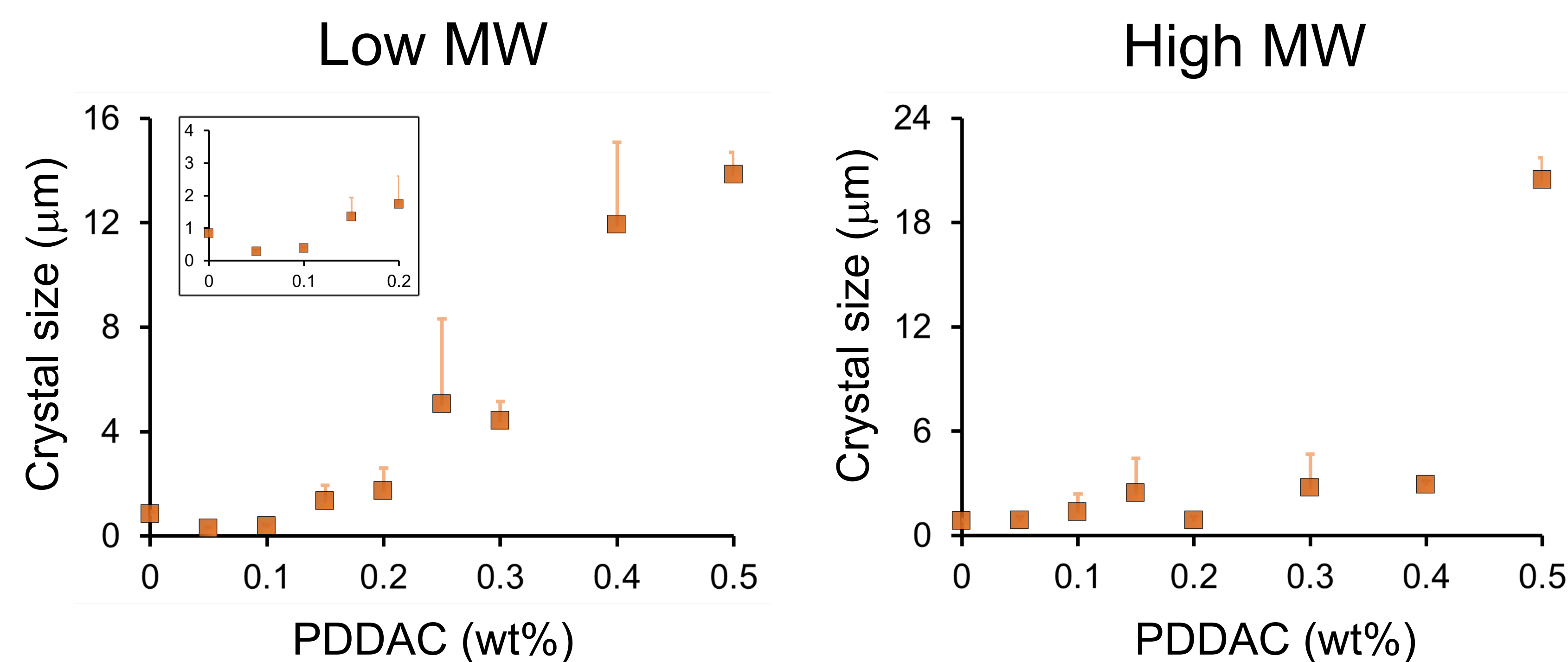
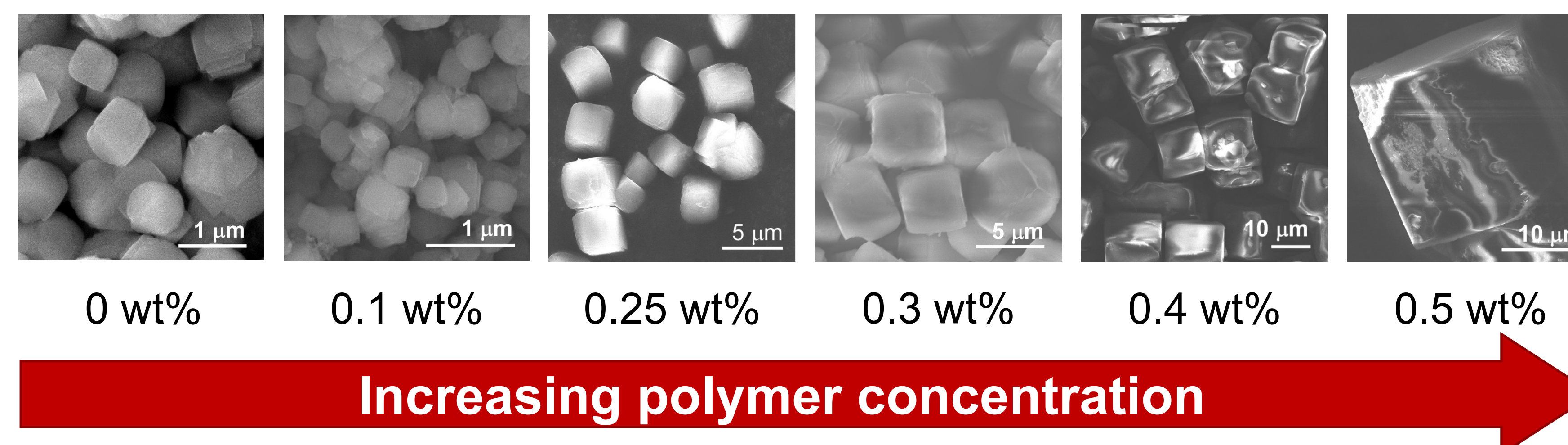


Ex situ Characterization of Control Sample



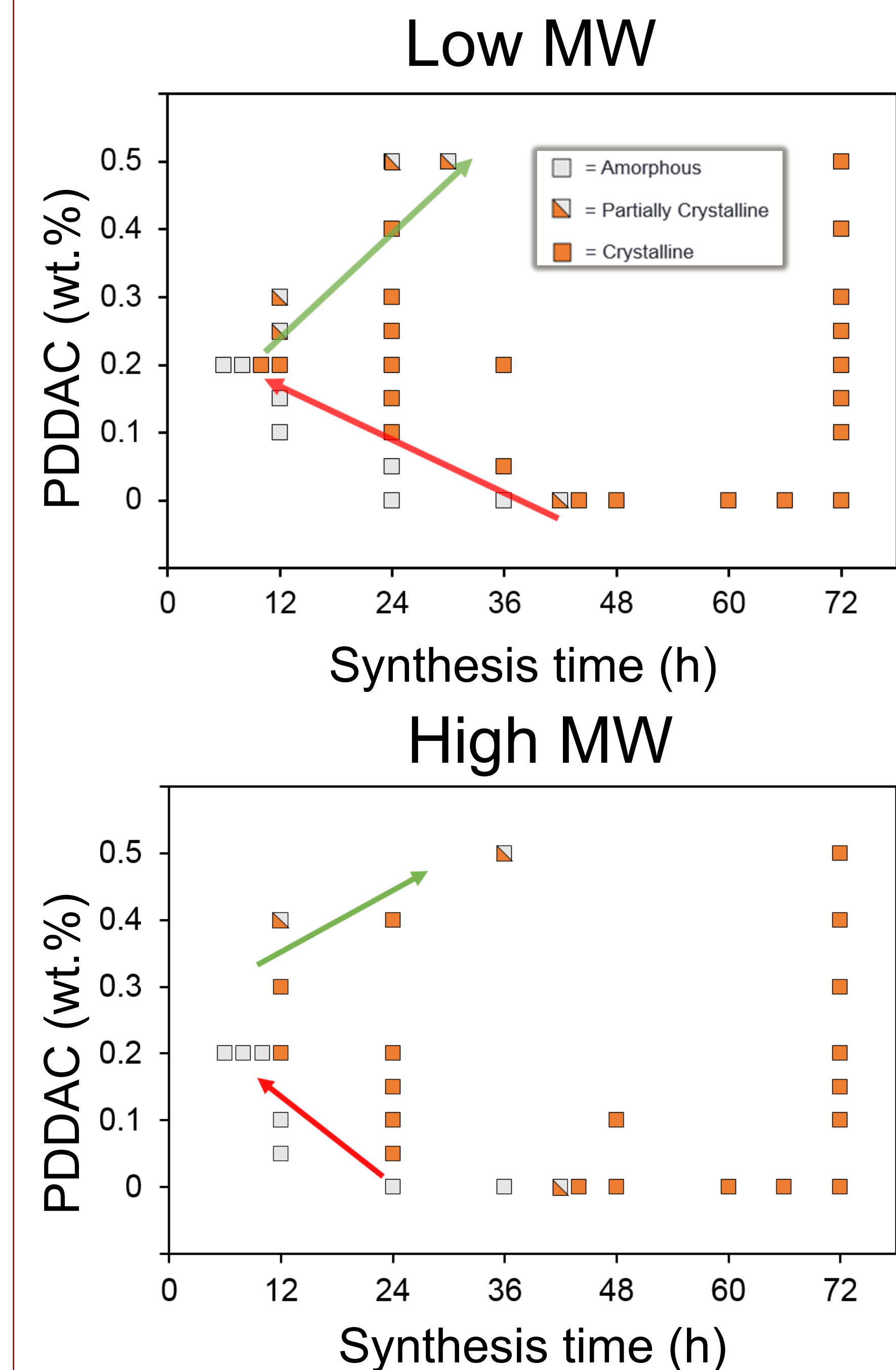
- Induction period lasts approximately 30 to 40 hours
- Smooth cubic morphology after 144 hours synthesis

Polymer Concentration Effects on Crystal Size



- Polymer addition can tune the crystal size by up to two orders of magnitude
- Crystal size is reduced in certain polymer concentrations for low MW polymer
- Nearly no observable size reduction trend for high MW polymer addition

Crystallization Time



Summary

- Crystal size generally increases with increasing low MW polymer concentration
- Synthesis time can be shortened using certain polymer concentrations

References

- Kumar et al. *J. Am. Chem. Soc.* 2015, 137(40), 13007-13017.
- Lupulescu et al. *J. Am. Chem. Soc.* 2013, 135(17), 6608-6617.

Acknowledgments

