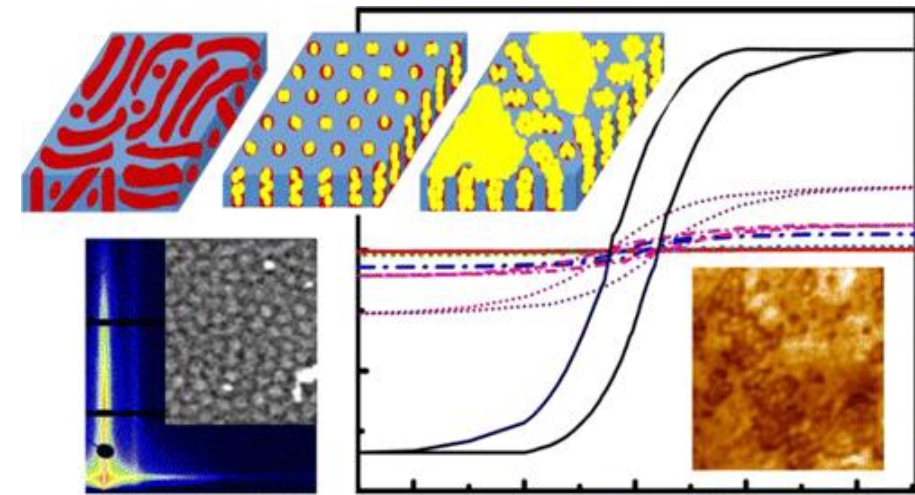


Motivation

Thermoresponsive Diblock Copolymer

- Phase separation above the lower critical solution temperature (LCST) [1]
- Swelling / Deswelling transition
- Hydrophilic / Hydrophobic balance
- Controllable diblock copolymer structure as template [2]
- Application in sensors, catalysts, optics, targeted drugs and etc. [3].

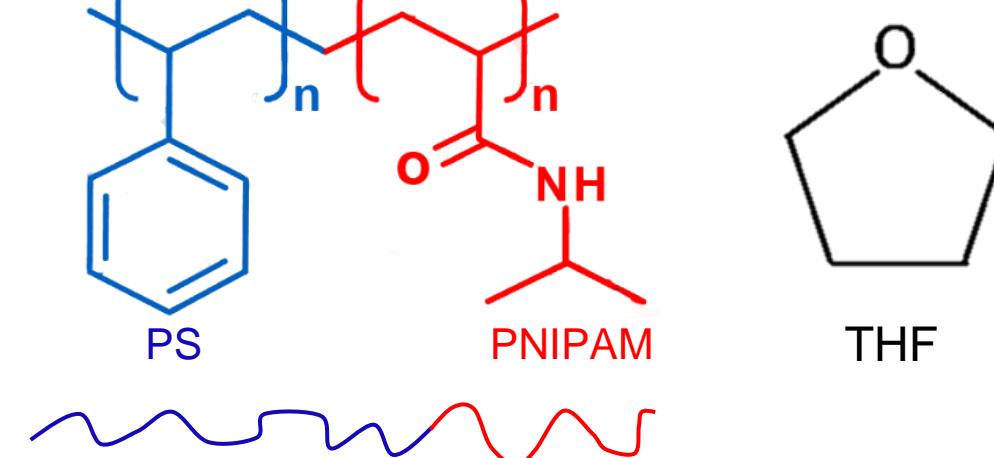


- Superparamagnetic hybrid films composed of maghemite (γ - Fe_2O_3) nanoparticles and an asymmetric diblock copolymer (DBC) polystyrene₆₁-block-polyN-isopropylacrylamide₁₁₅ [4]

Materials and Structure

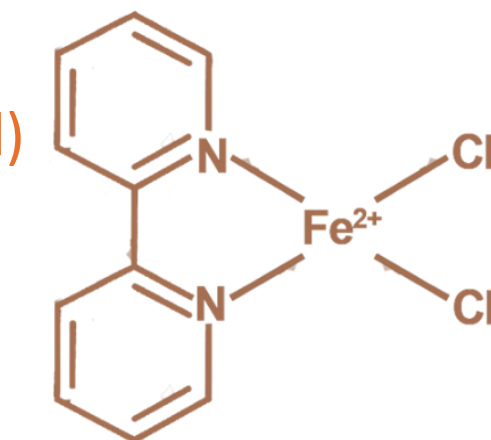
Thermoresponsive DB Copolymer

- PS-b-PNIPAM**
 - M_n (16000-b-9500), 1.68
 - dissolved in tetrahydrofuran (THF)
- PS-b-PNIPAM**
 - M_n (11500-b-24000), 2.08
 - dissolved in tetrahydrofuran (THF)



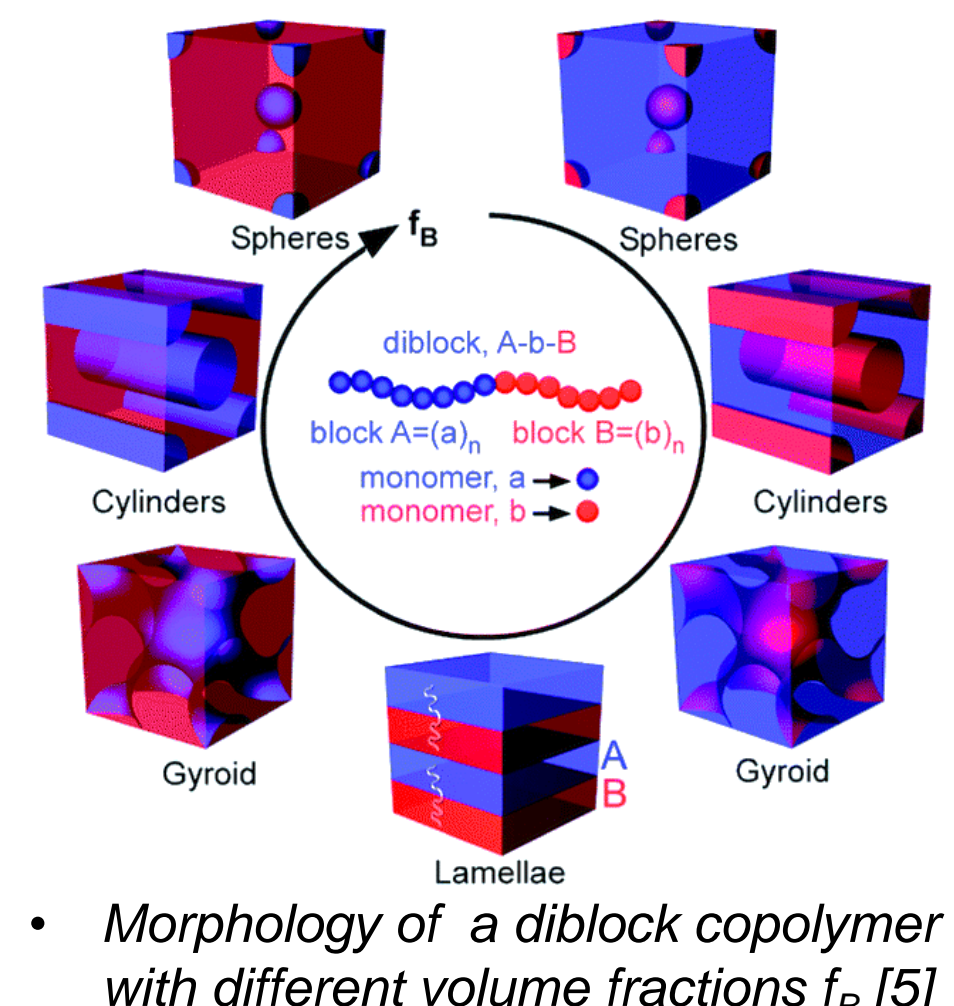
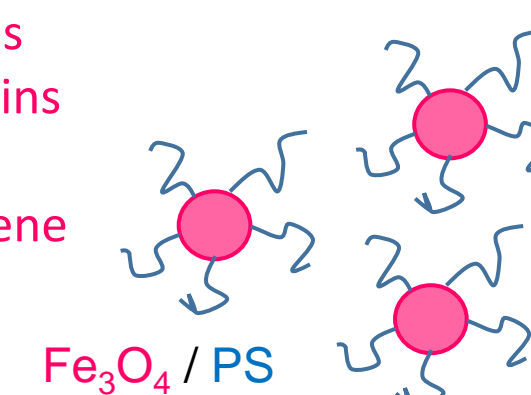
Iron Salt

- $\text{FeCl}_2(2, 2'\text{-dipyridyl})$
 - dissolved in methanol
 - goes to PNIPAM block (polarity)



Iron Oxide Nanoparticles

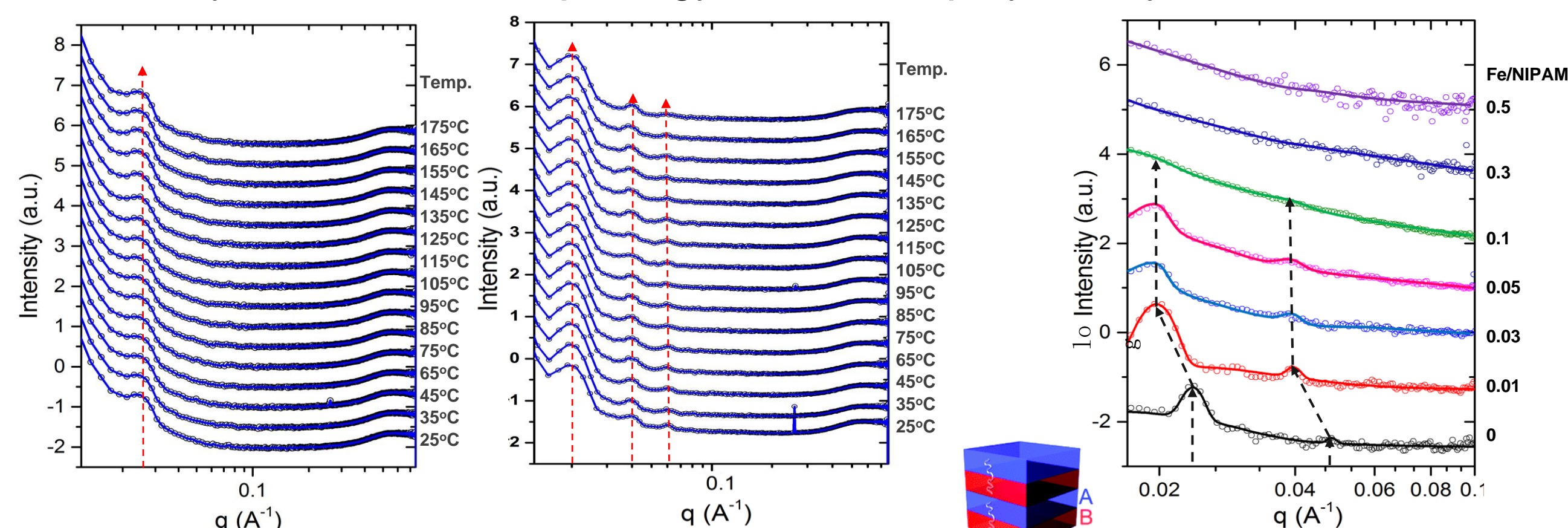
- Fe_3O_4 nanoparticles
 - coated by PS chains
 - goes to PS block
 - dissolved in toluene



- Morphology of a diblock copolymer with different volume fractions f_B [5]

Bulk Structure (Static SAXS)

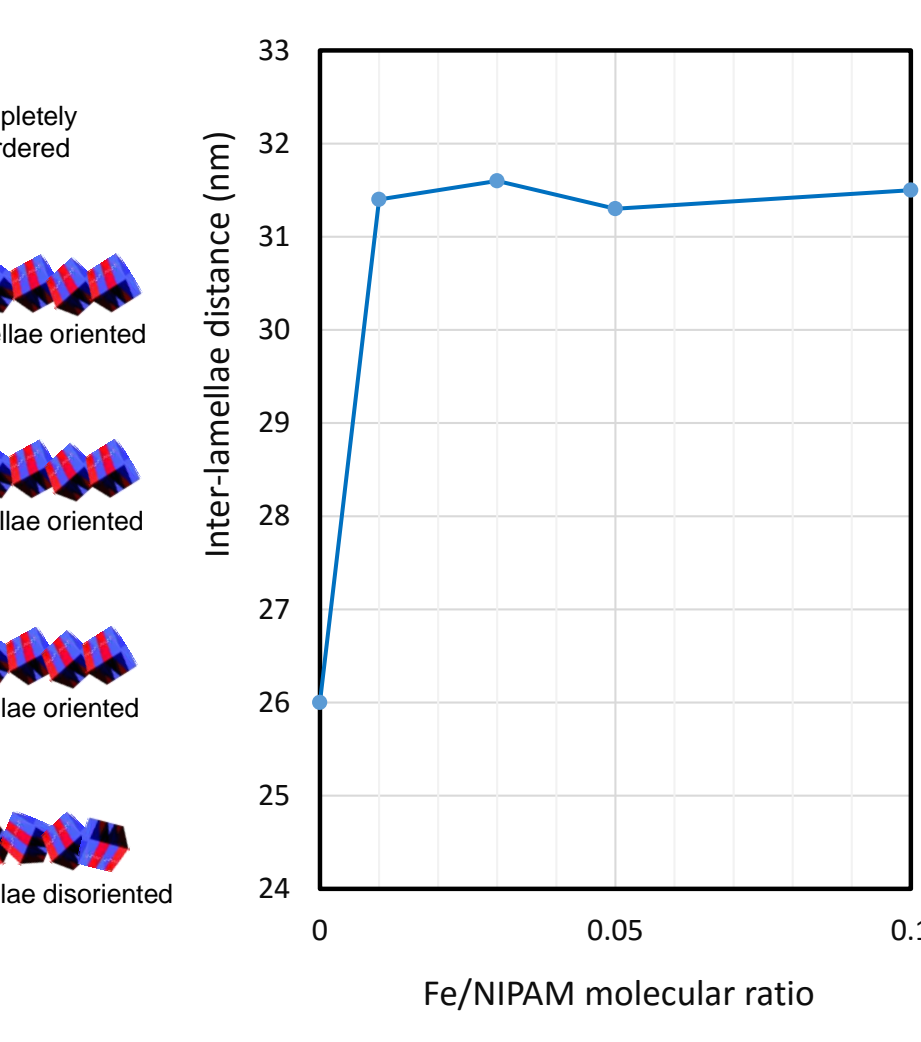
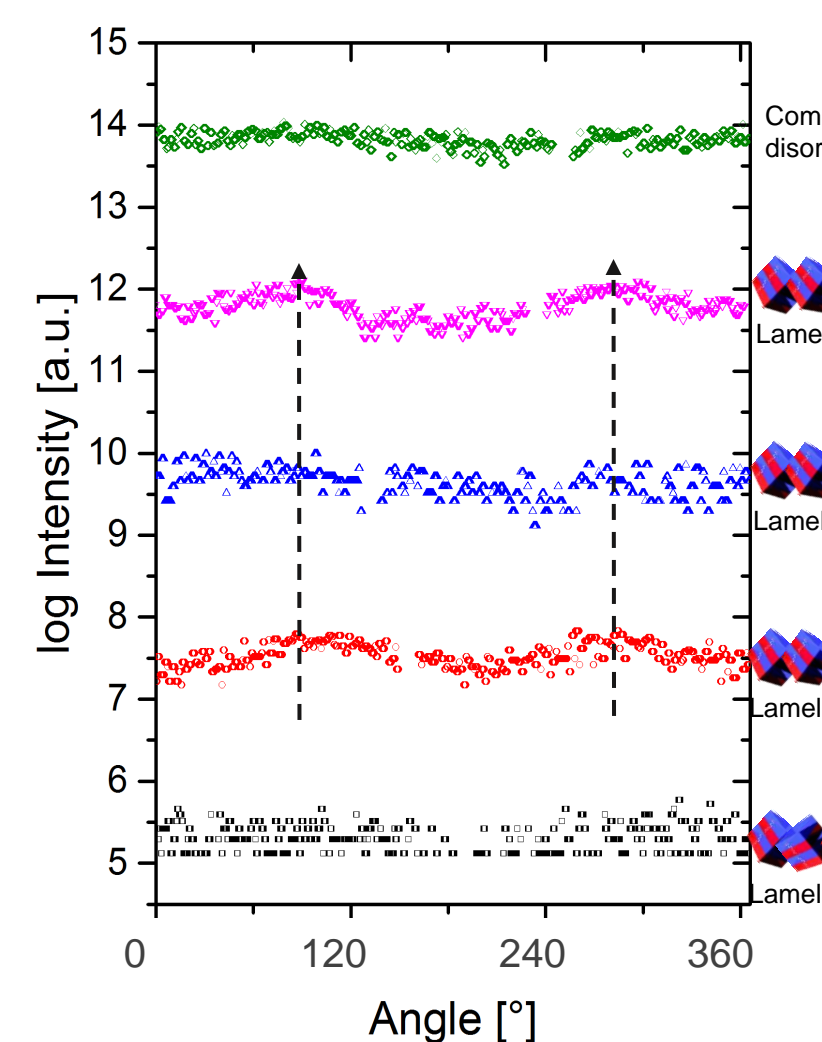
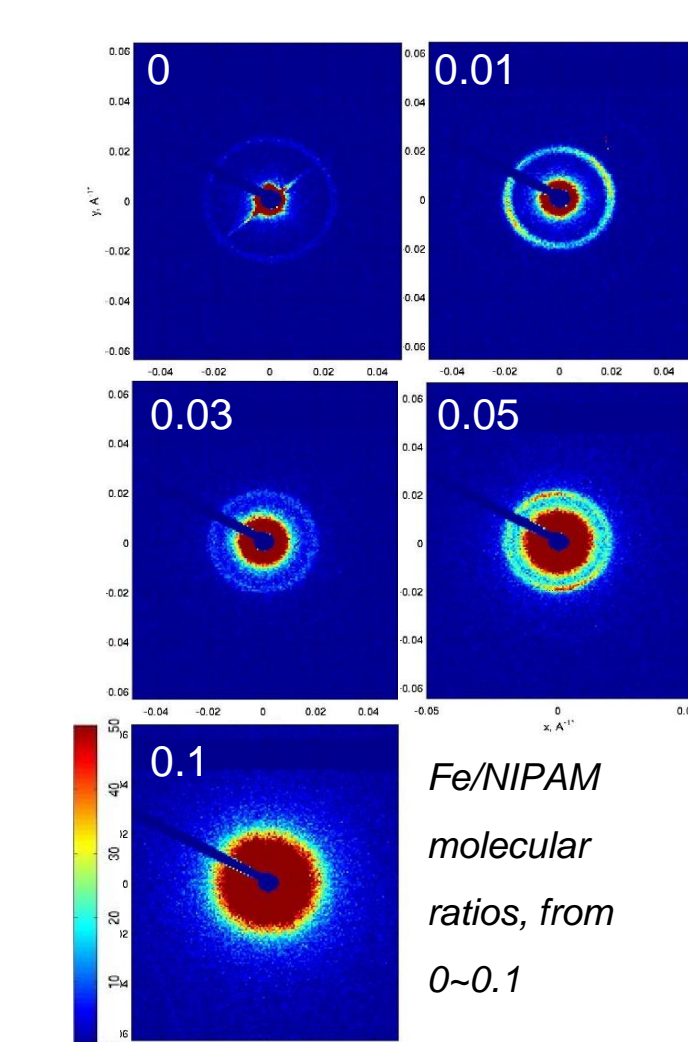
- Small angle X-ray scattering (SAXS)** measurements were carried out to analyze the inner morphology of the iron-polymer hybrid materials.



- Thermal stability study of Pure PS-b-PNIPAM

- Thermal stability study of iron oxide / PS-b-PNIPAM nanocomposites (Fe/NIPAM: 0.01)

- SAXS profile of iron oxide/ PS-b-PNIPAM nanocomposites

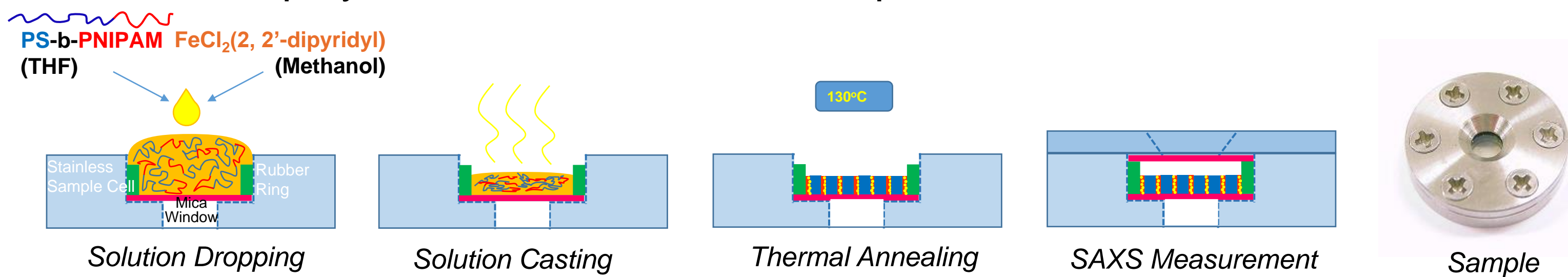


- Degree of Orientation

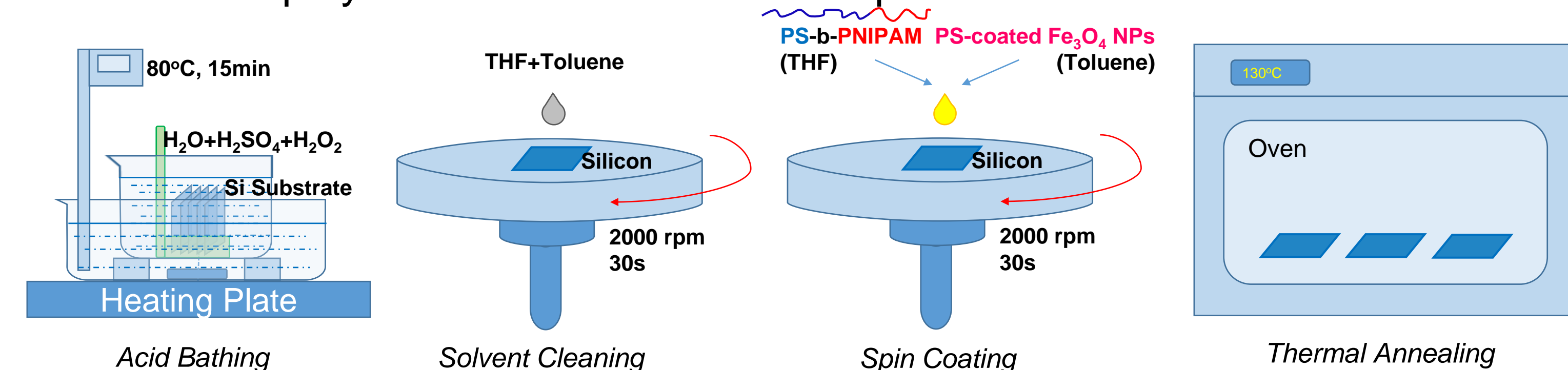
- Lamellae spacing D versus Fe/NIPAM molecular ratio

Sample Preparation

- Bulk DB Copolymer / Iron Oxide Nanocomposites**

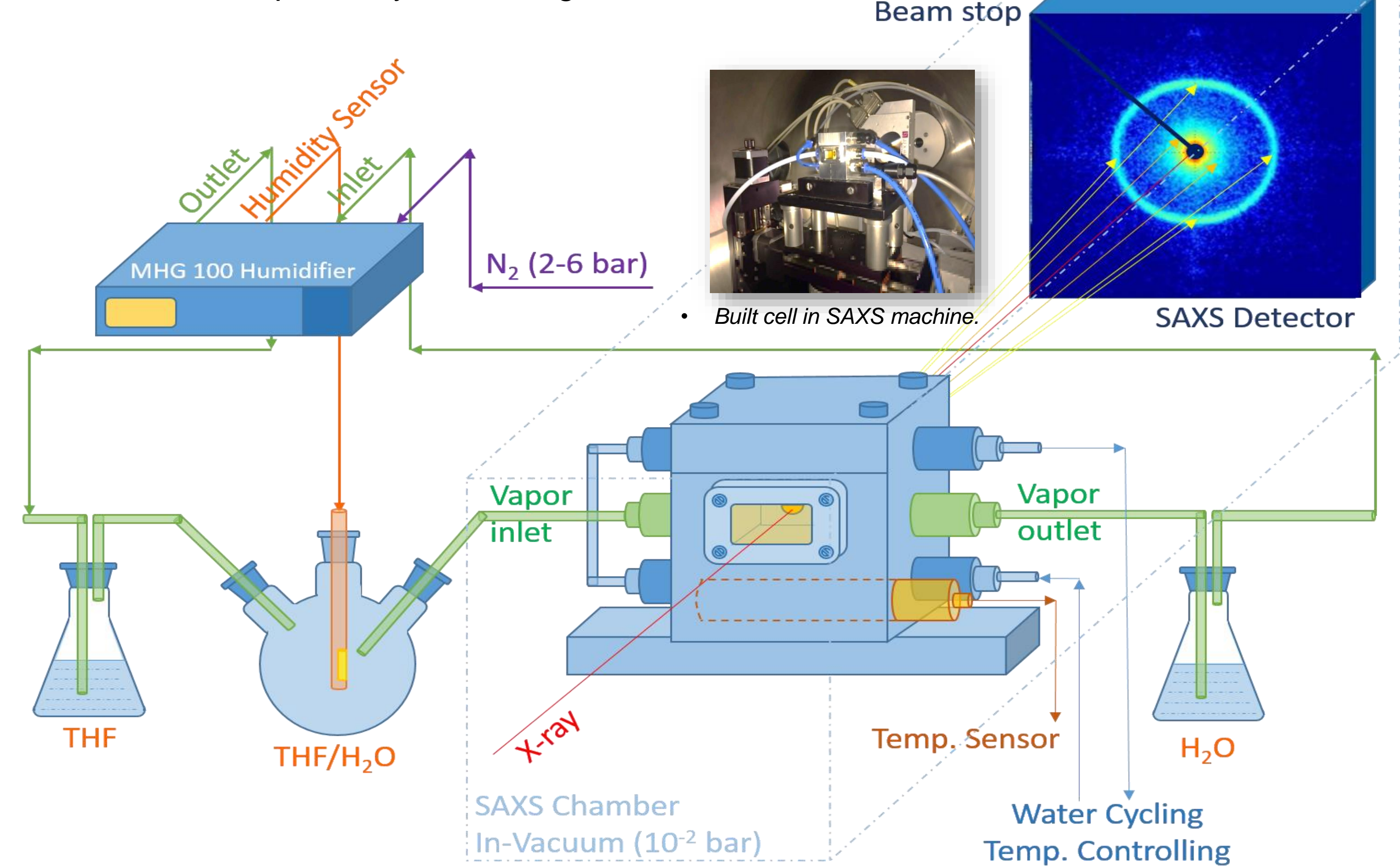


- Film DB Copolymer / Iron Oxide Nanocomposites**



Temperature & Humidity Controlling Cell (in-situ SAXS)

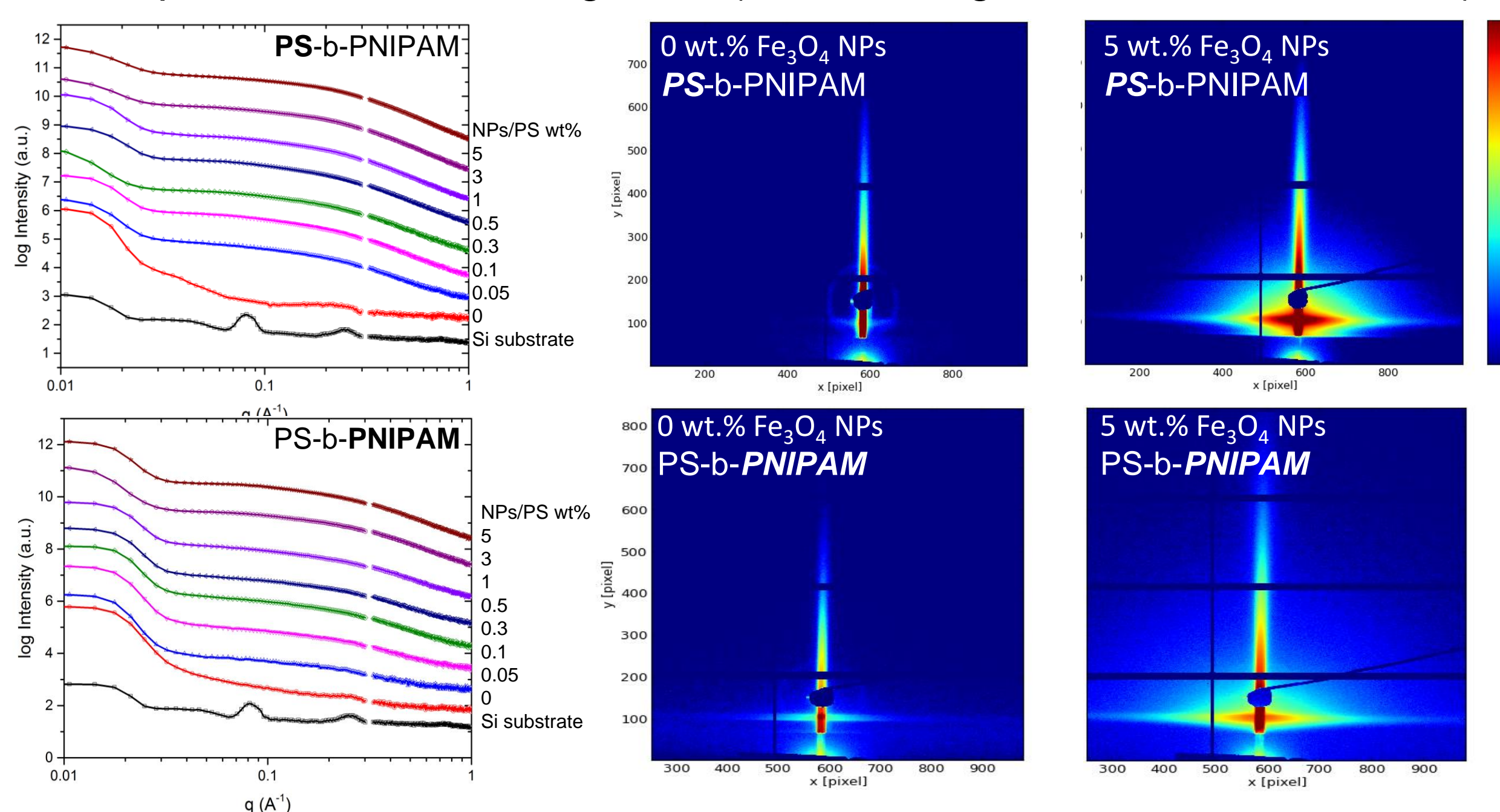
- Since PNIPAM domain is responsive to both temperature and humidity, a cell was designed and built to have precisely controlling for desired block structure.



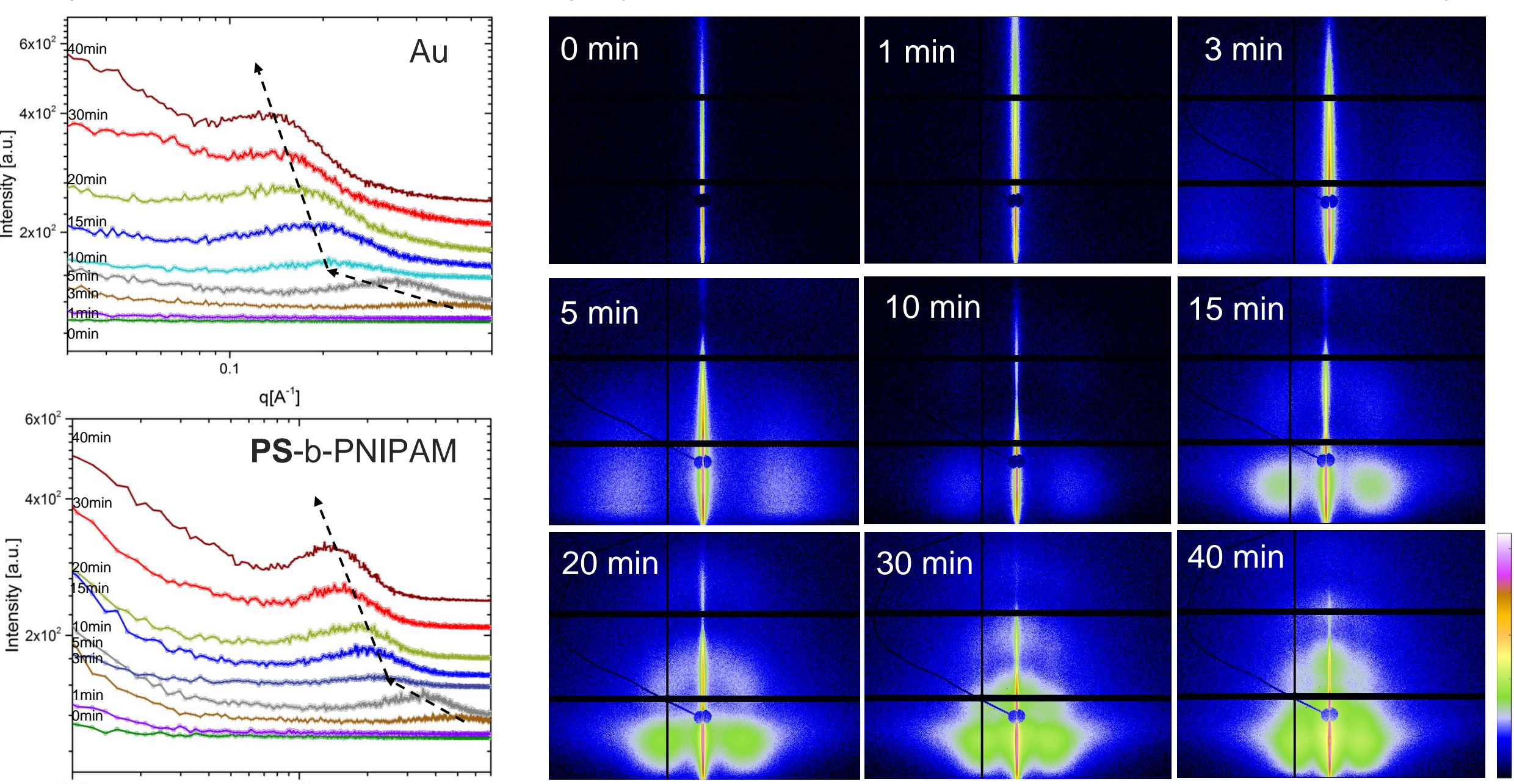
- Configuration of temperature and humidity controlling cell for thermoresponsive iron oxide/PS-b-PNIPAM hybrid materials.

Film Structure (Static & Sputtering GISAXS)

- Static GISAXS were performed at Elettra and both polymers with nanoparticles were investigated. (Incident-angle @ 0.43°, 8Gev, 200s)



- Sputtering GISAXS were performed at DESY for Pure Polymer
- (Power: 150 w; Pressure(Ar): 0.020 mbar; Rate: 0.007 nm/s; @0.4°)



Outlook

- Investigate the iron oxide/PS-b-PNIPAM hybrid materials with built temperature and humidity controlling cell.
- Use PNIPAM dominated PS-b-PNIPAM to have thermoresponsive PNIPAM framework.
- Study the influence of iron oxide/PS-b-PNIPAM hybrid structures on its magnetic properties.

References

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