



# Molecular Architecture Effect of Soft Materials on Structure and Defect Formation

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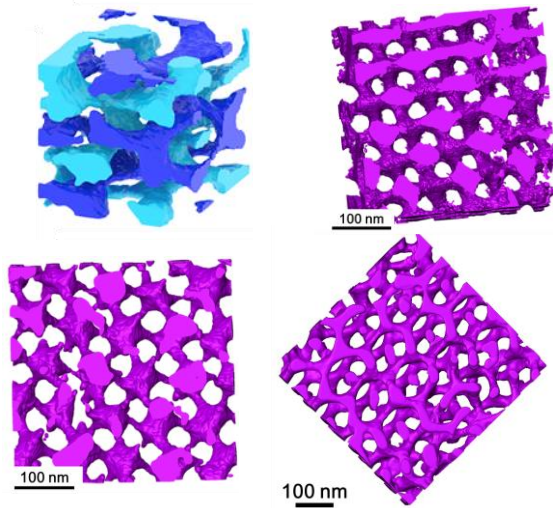
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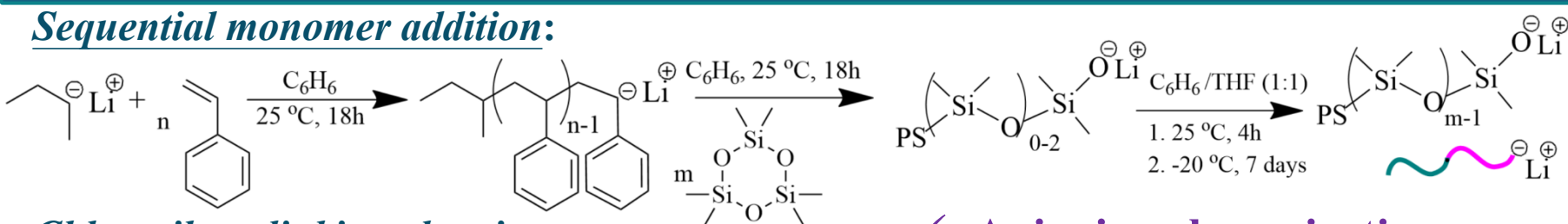
## Motivation

- ✓ Synthesis of polystyrene-*b*-poly(dimethylsiloxane) copolymers (PS-*b*-PDMS)
- ✓ High  $\chi$  linear and non-linear copolymers
- ✓ Tunable phase behavior (solvent vs. architecture)
- ✓ Interplay between intricate nanostructures
- ✓ Advanced mechanical, optical, transport properties
- ✓ Various applications after templating processes

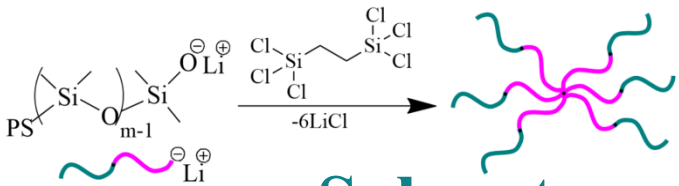


## Synthesis

### Sequential monomer addition:



### Chlorosilane linking chemistry:



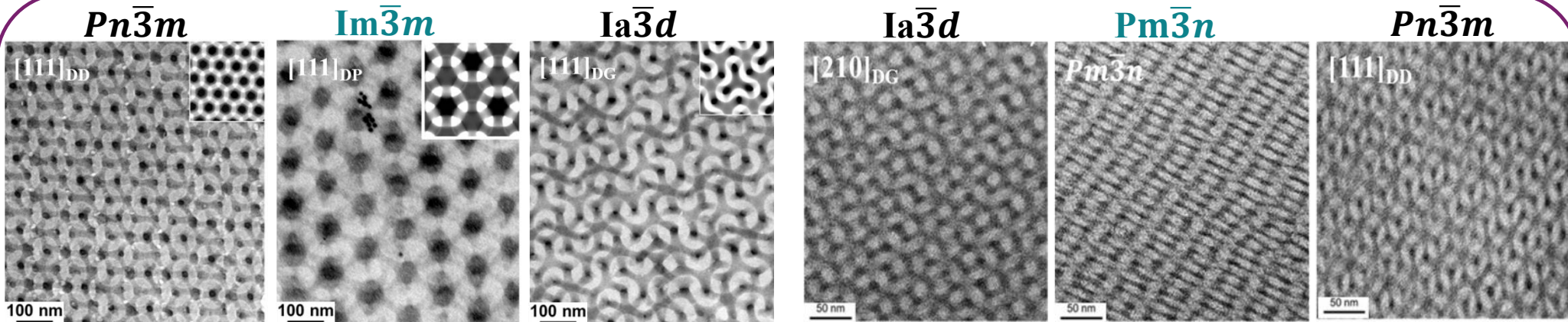
- ✓ Anionic polymerization
- ✓ High vacuum conditions
- ✓ Multifunctional compounds
- ✓ Fractionation

## Solvent vs. Architecture Effect Results

### Linear Copolymer

### ✓ Real Space

### Six-Arm Star



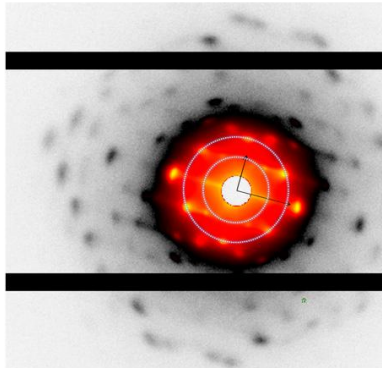
Transmission electron microscopy (TEM) images using chloroform under various evaporation rates (black regions correspond to PDMS and white to PS)

TEM images using various selective solvents including chloroform, toluene, dichloromethane (black regions correspond to PDMS and white to PS)

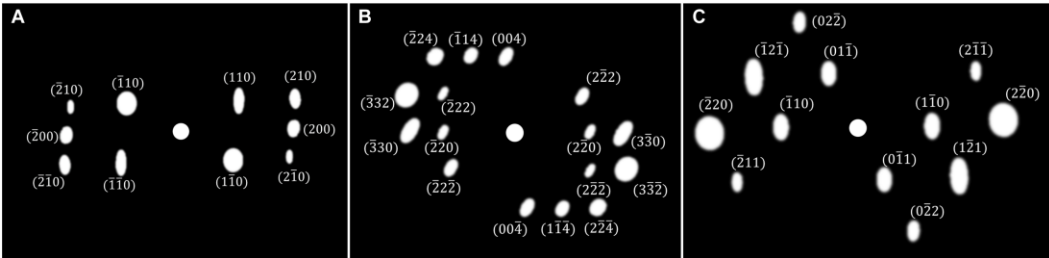
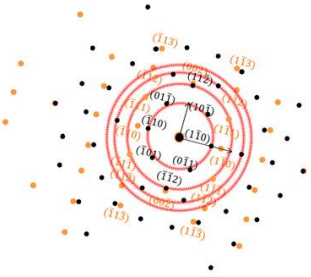
### Double Primitive

### ✓ Reciprocal Space

### Frank-Kasper



Coexistence of the [111] zonal diffraction of the DP phase (black dots) and the [110] zonal diffraction of the DD phase (orange dots)

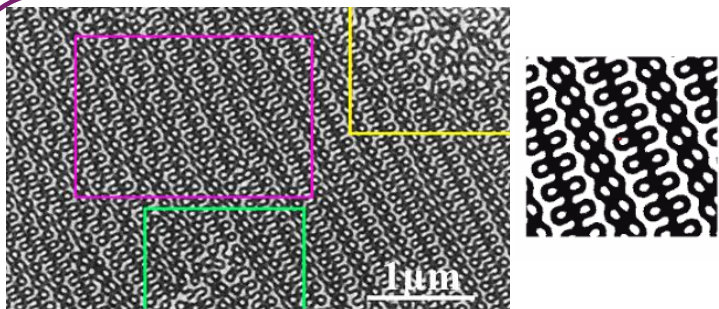


3D Fast Fourier transform (3D FFT) showing various projections along the (A) [001], (B) [110], and (C) [111] zonal axes.

## Defects Formation

### Linear Copolymer

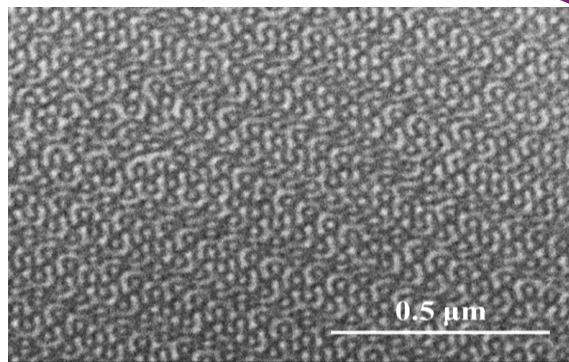
### Six-Arm Star



Slice and view scanning electron microscopy (SVSEM) images of DG structure (mag: 25000 x). Highlighted areas showcasing specific DG slice planes and/or defects indicating the breakage of symmetry. A (143) slice simulation is provided. PDMS regions are bright, and PS are dark.



SEM micrograph of DG structure during slice and view, the holes correspond to the ion beam fiducials)



FIB cross sectional SEM image indicating the formation of network phase in a non-linear copolymer

### ACKNOWLEDGEMENT

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