両親媒性分子のDSC-SAXSによる構造変化の観察

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第12回ヘルスケアー研究会 2011/12/13

測定法が変わると?

マクロな特性

熱分析
DSC

熱容量
状態
相図
自由度

走査速度　10 K/min
時間分解能　0.05～0.1 sec

分光
FTIR

コンホメーション
相互作用

時間分解能　0.01～0.1 sec

回折・散乱
WAXD SAXS

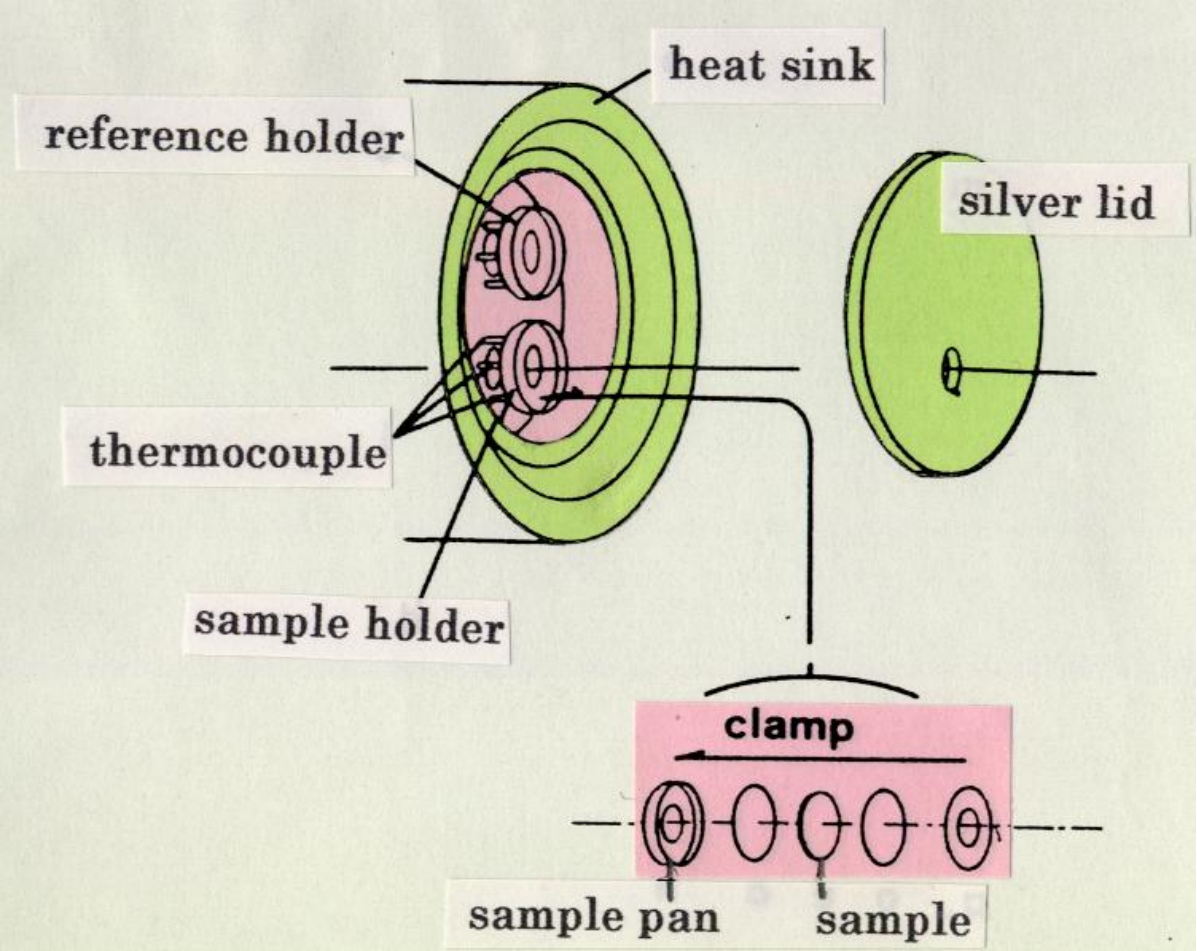
構造
凝集状態
分散状態

時間分解能　1～100 sec

ミクロな構造

同時測定DSC

熱分析
DSC



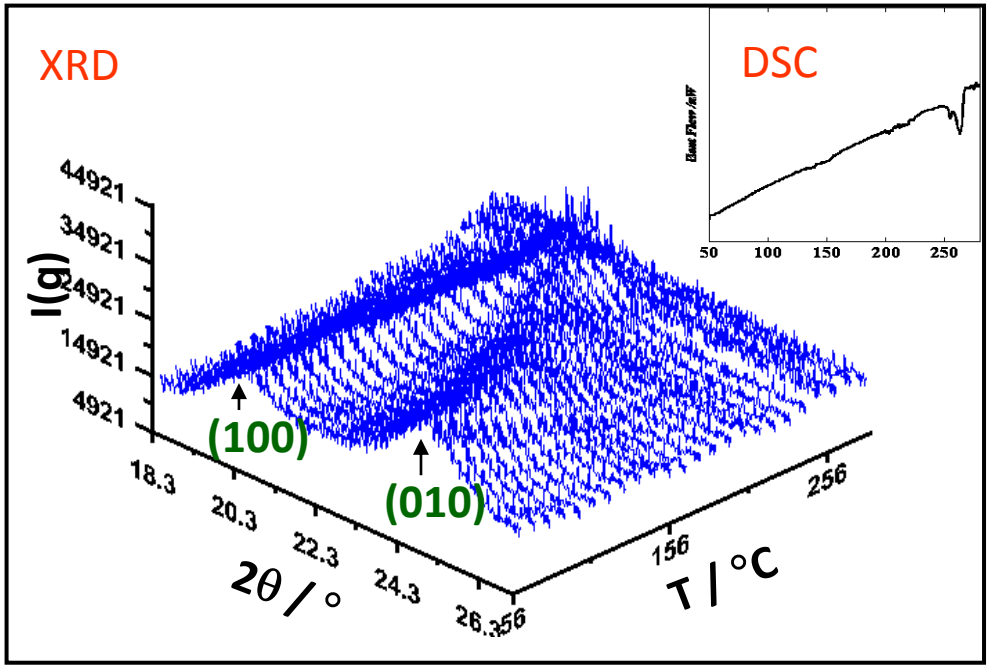
同時測定DSCで何が判るか?

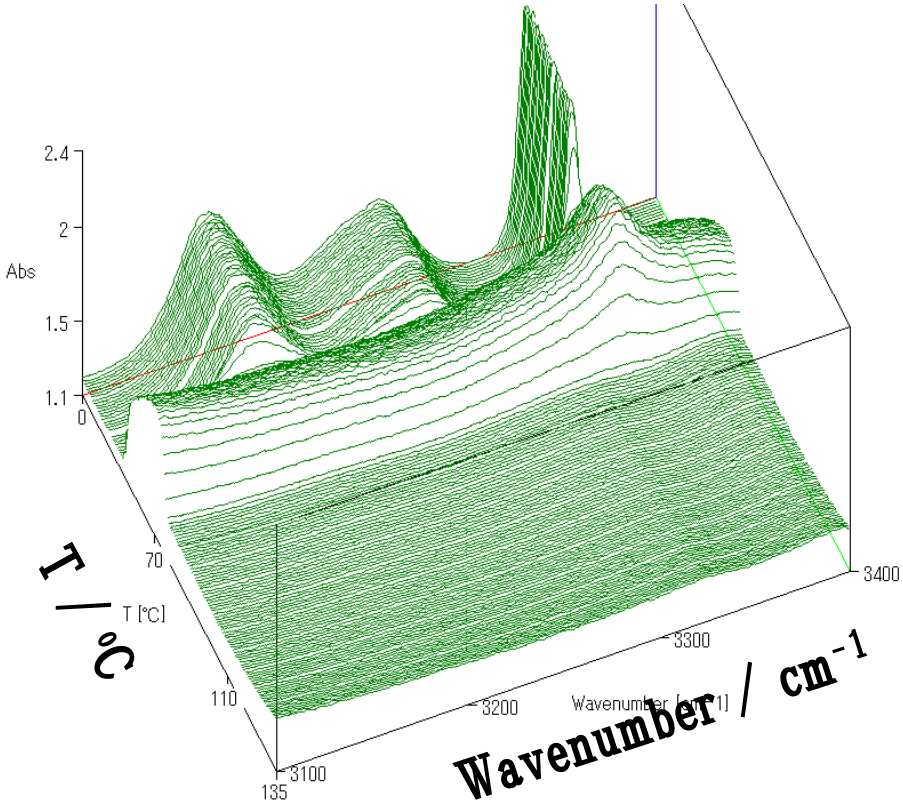
回折・散乱
WAXD SAXS

分光
FTIR

長鎖アミン
融解
等方相転移

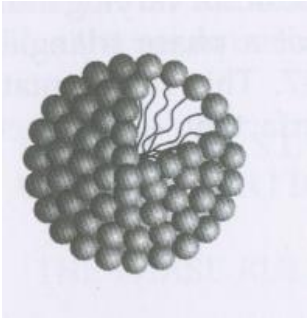
ナイロン66　固相転移



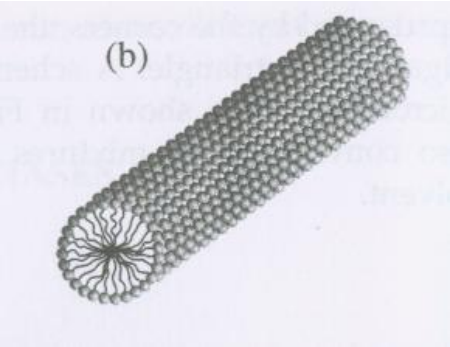


両親媒性分子の凝集構造

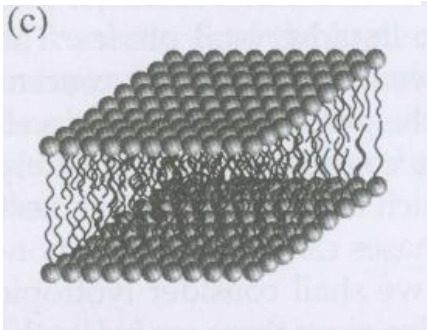
球状ミセル

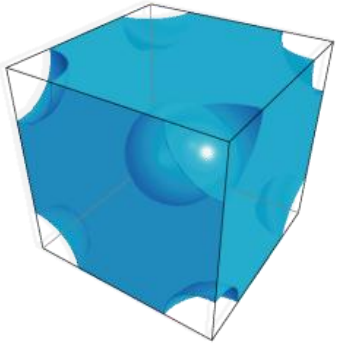


棒状ミセル



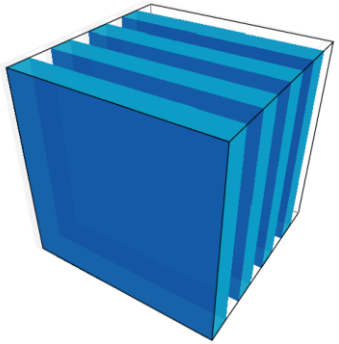
板状ミセル





BCC

HPC



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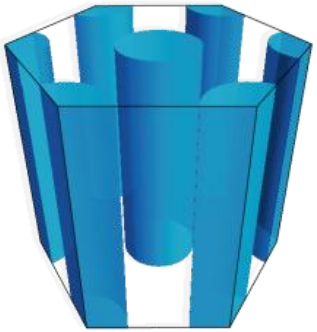
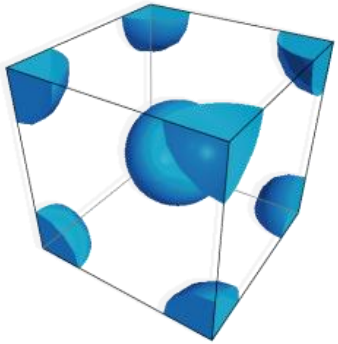
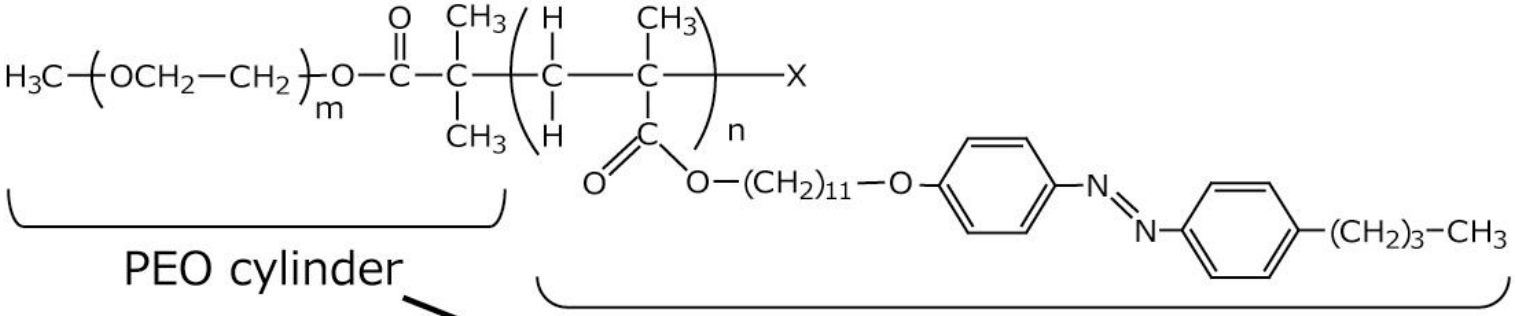


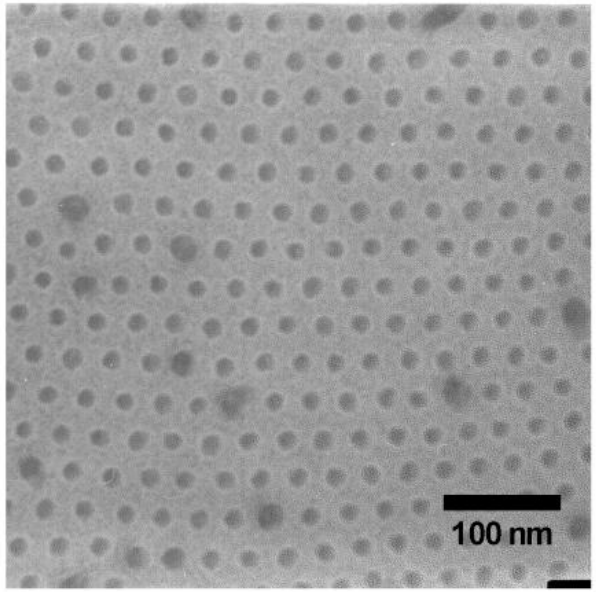
HPC

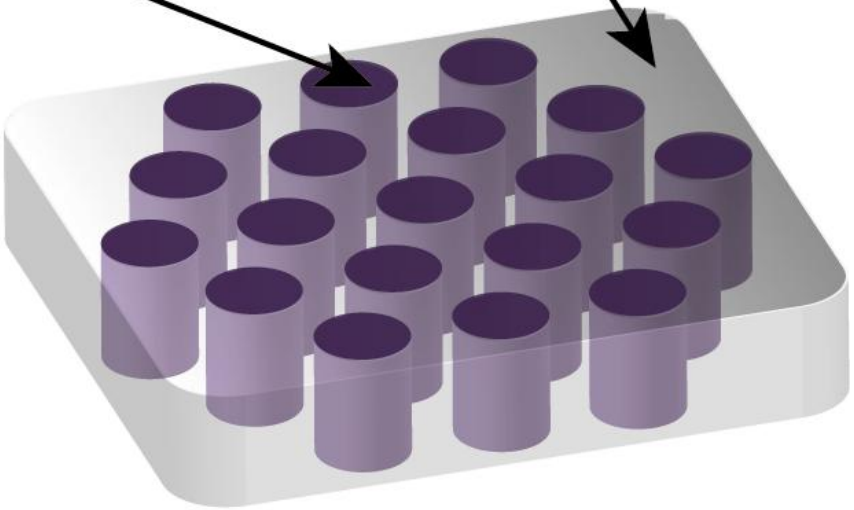


BCC

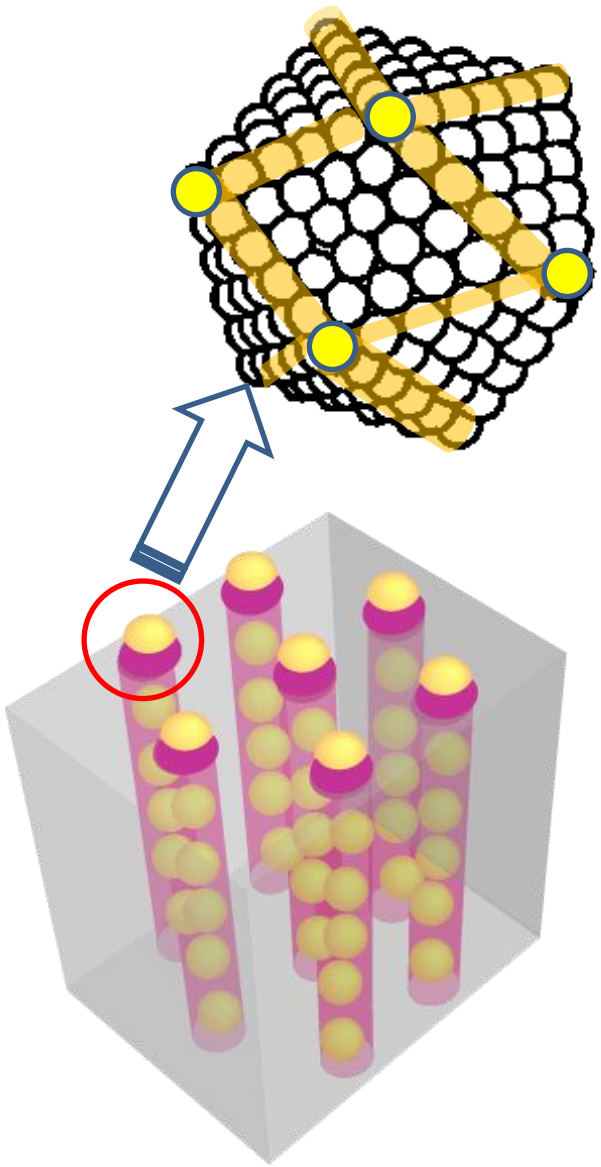
両親媒性ブロック共重合体の相分離構造







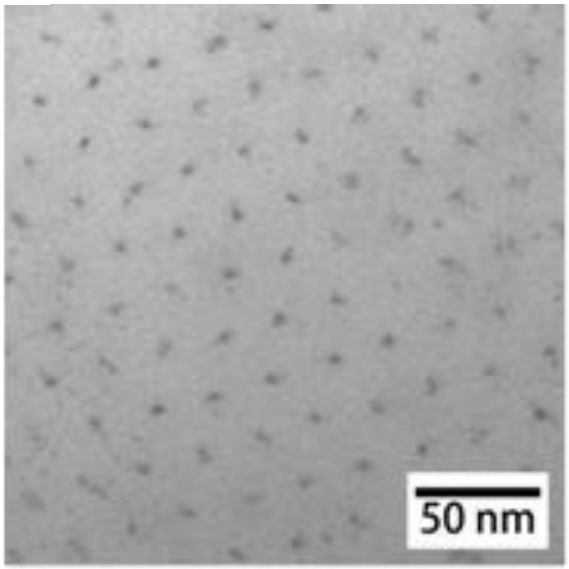
相分離構造を反応場として



金クラスター
D ≈ 2 nm　561個

分子フラスコ

サイズと配列の制御



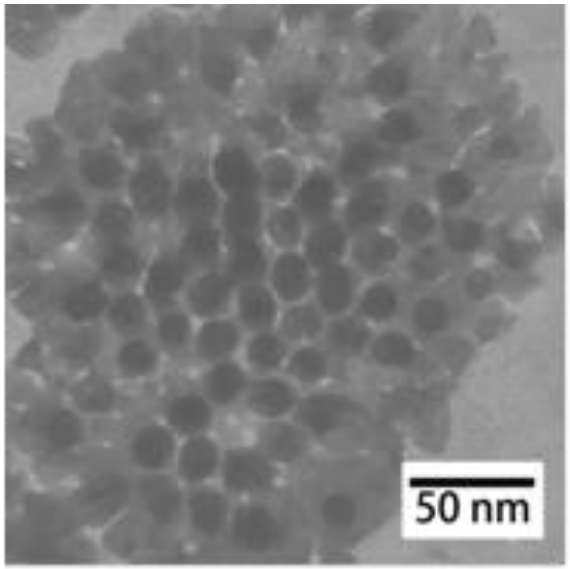
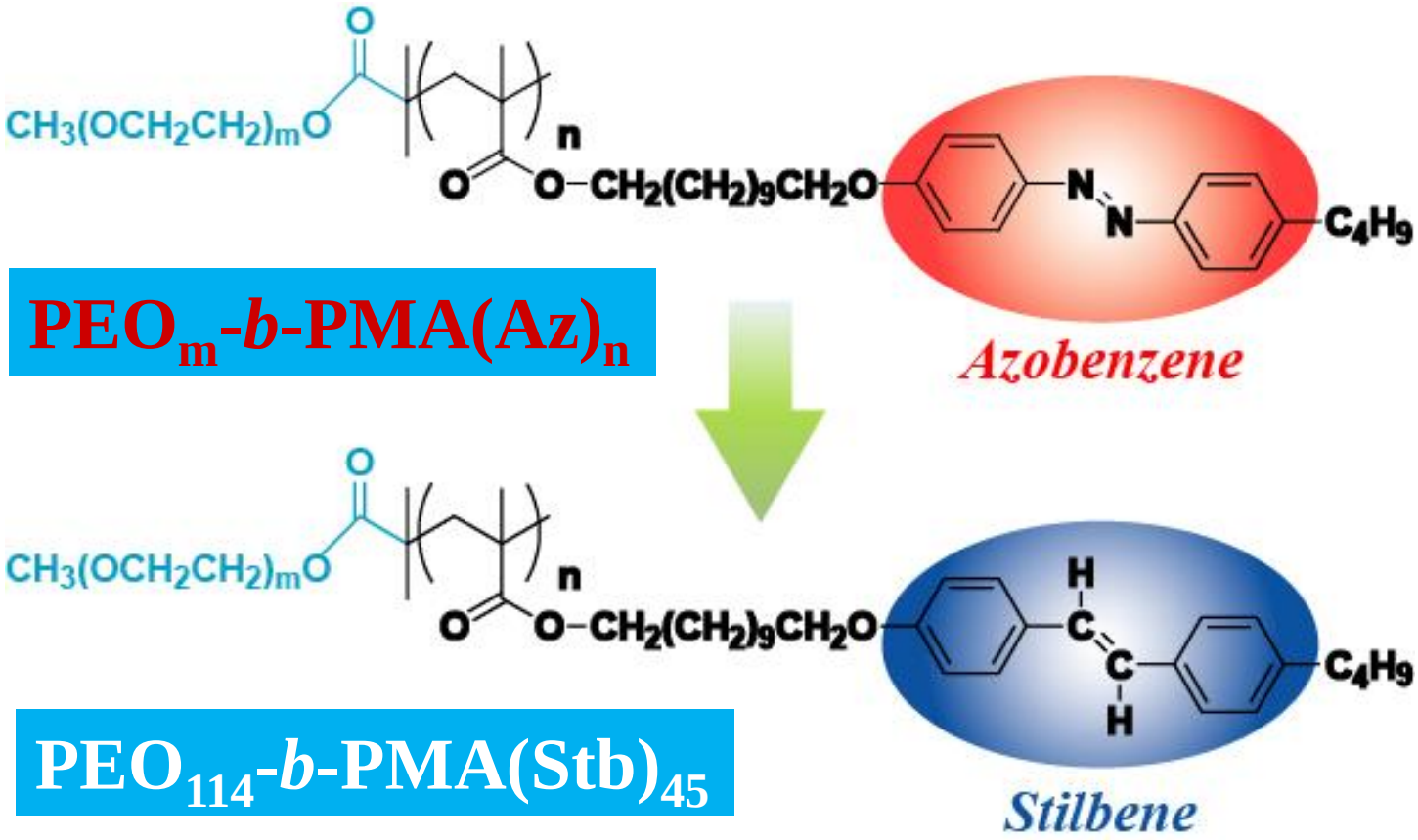


図 2 ブロック共重合体を利用した金の規則配列，金クラスター(左)、金ナノロッド(右)

液晶型両親媒性ブロック共重合体

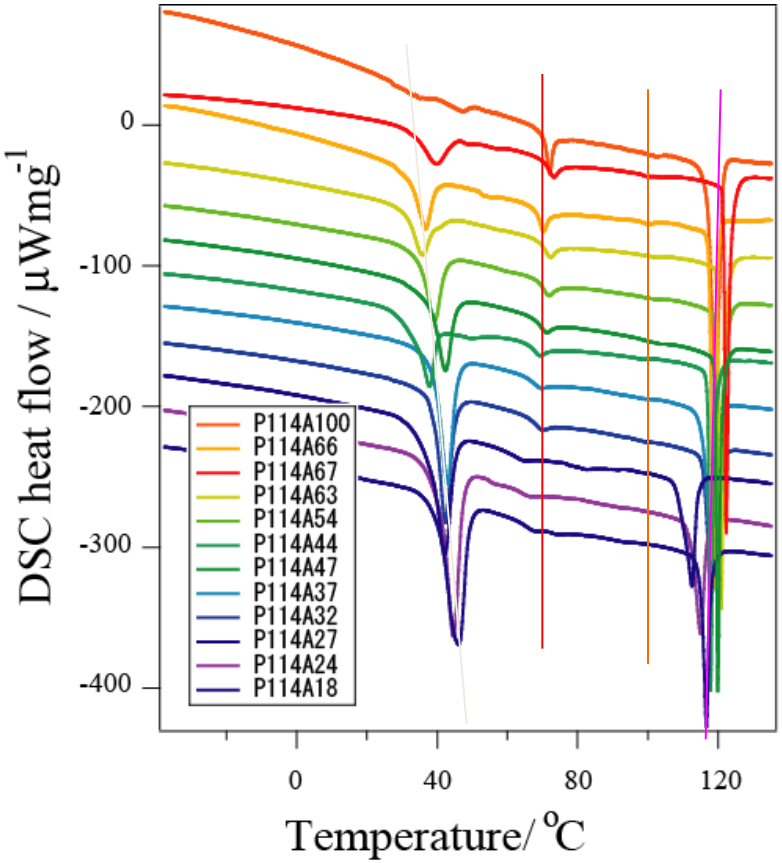
PEO_n-*b*-PMAR_m

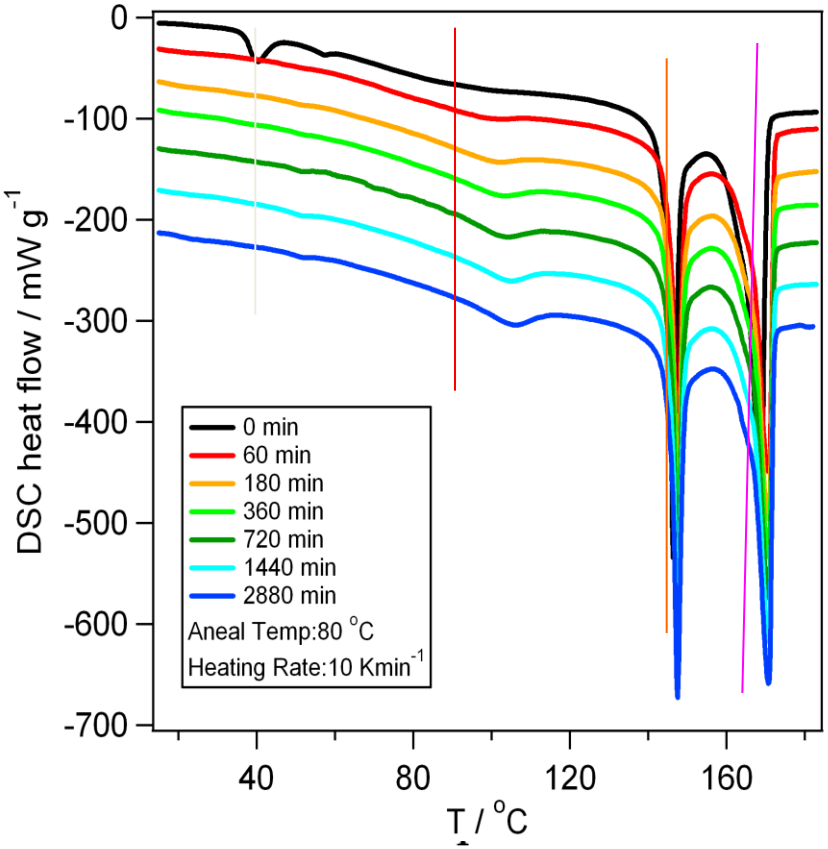


PEO_m-*b*-PMA$(Az)_n$

PEO_{114}-*b*-PMA$(Stb)_{45}$

PEO_n-*b*-PMAR：相転移

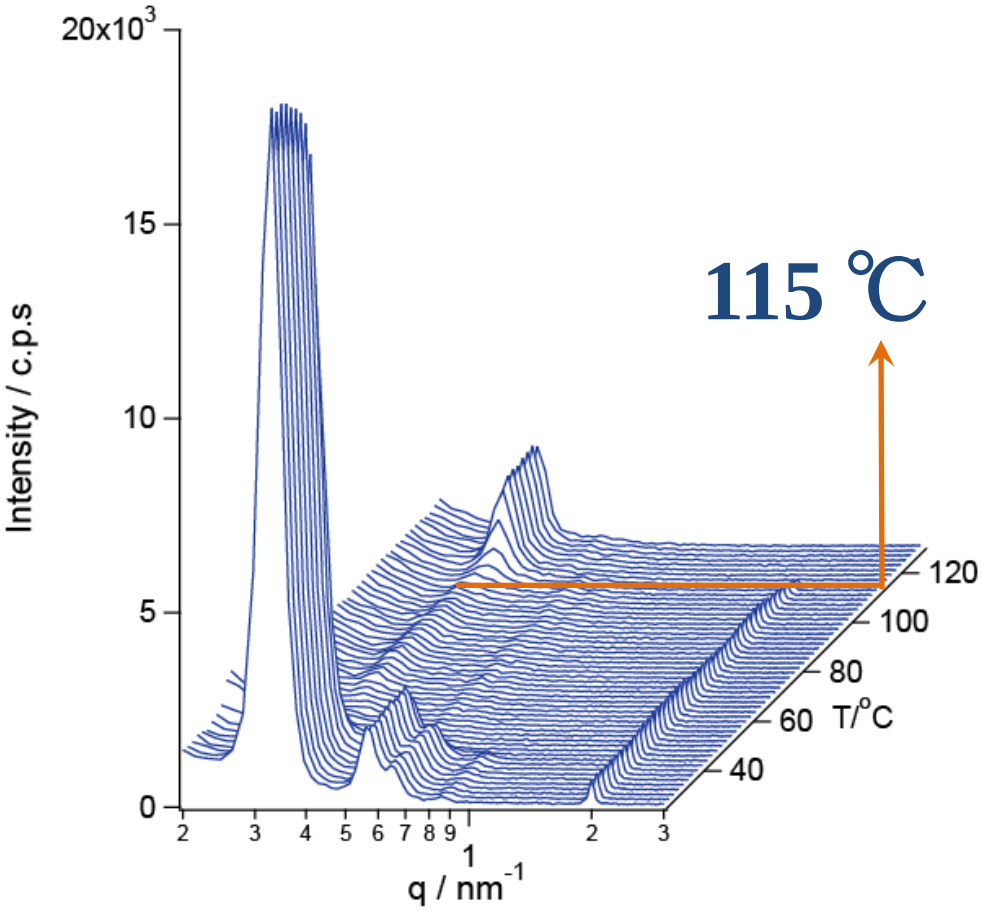


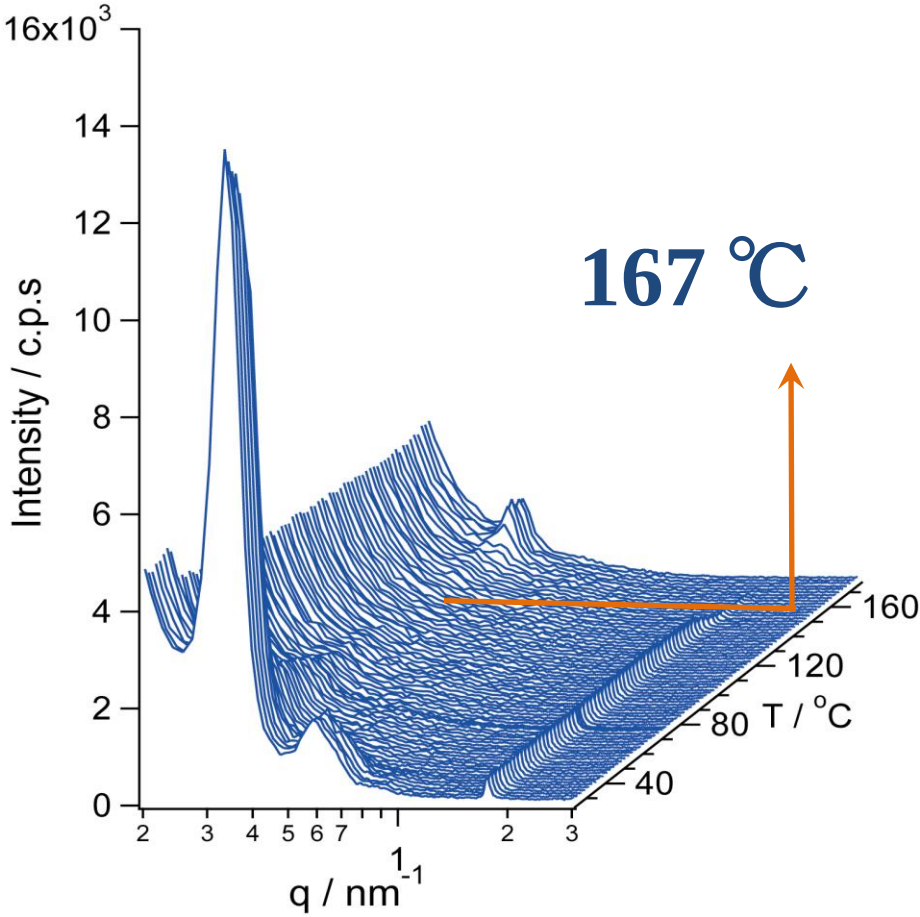


PEO_{114}-*b*-$PMA(Az)_m$

PEO_{114}-*b*-$PMA(Stb)_m$

PEO_m-*b*-PMAR_n : DSC-SAXS

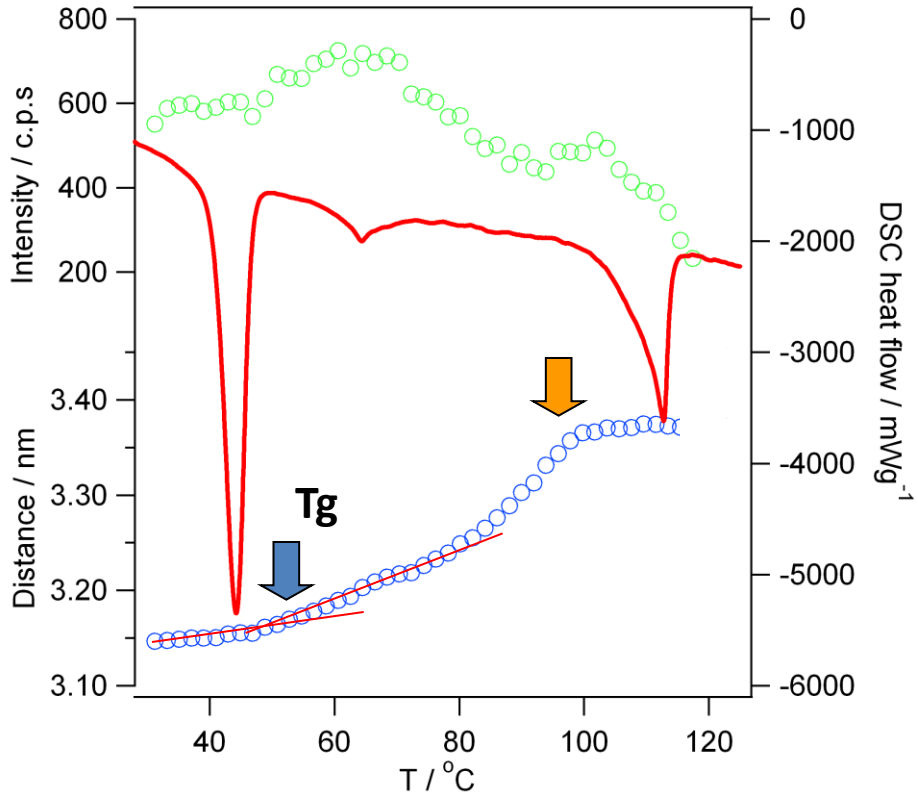




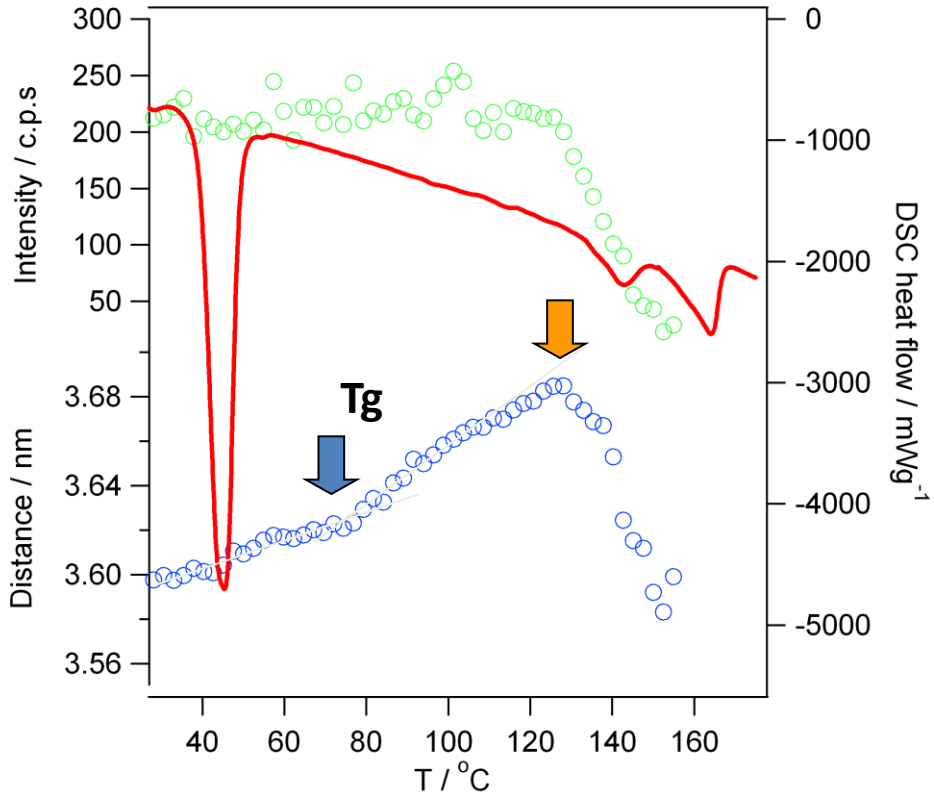
PEO_{114}-*b*-PMA$(Az)_{45}$

PEO_{114}-*b*-PMA$(Stb)_{45}$

PEO_m-*b*-PMAR_n：スメクチック相

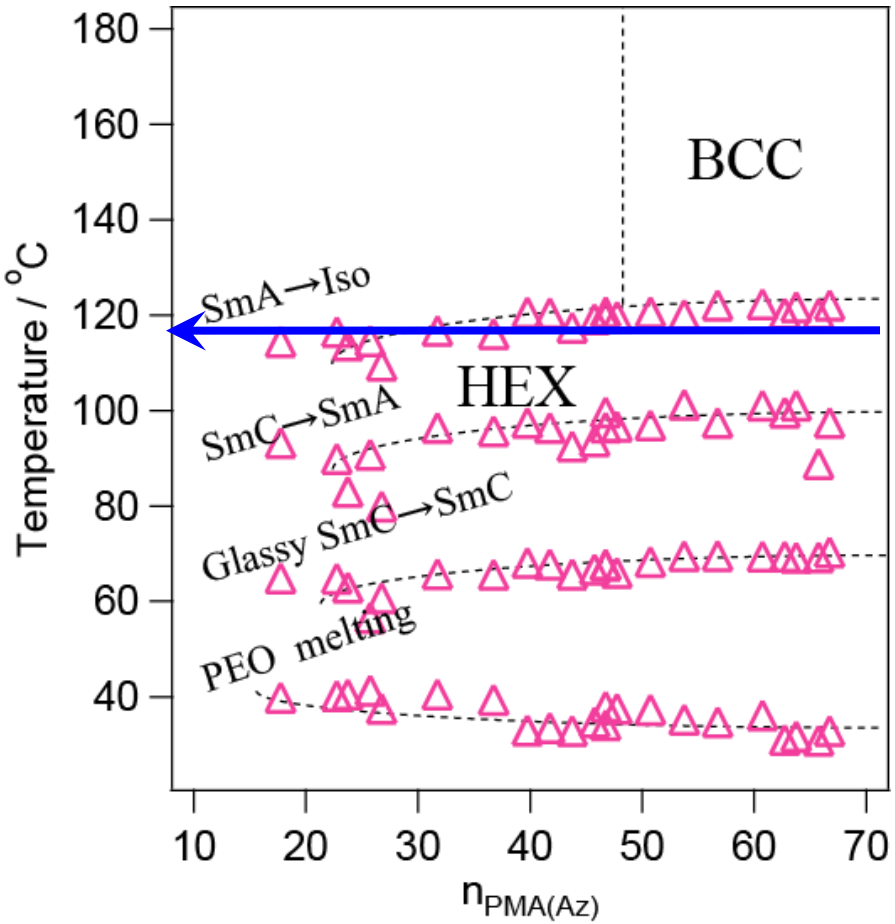


PEO_{114}-*b*-PMA$(Az)_{45}$

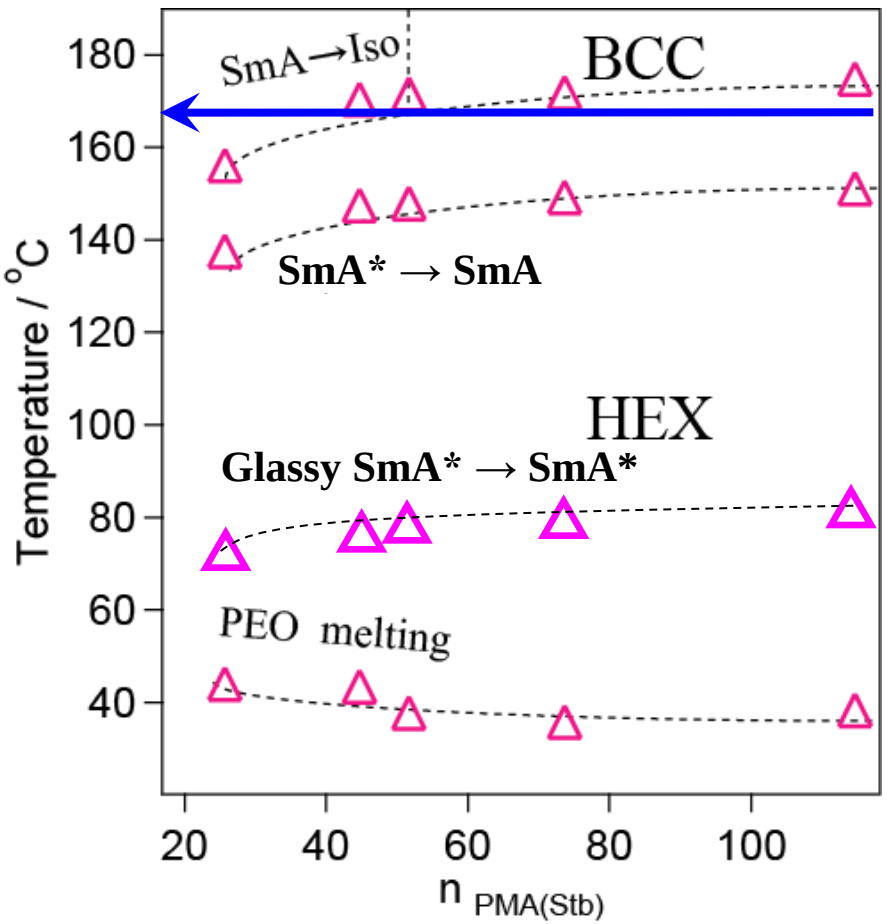


PEO_{114}-*b*-PMA$(Stb)_{45}$

PEO_m-*b*-PMAR_n：相図

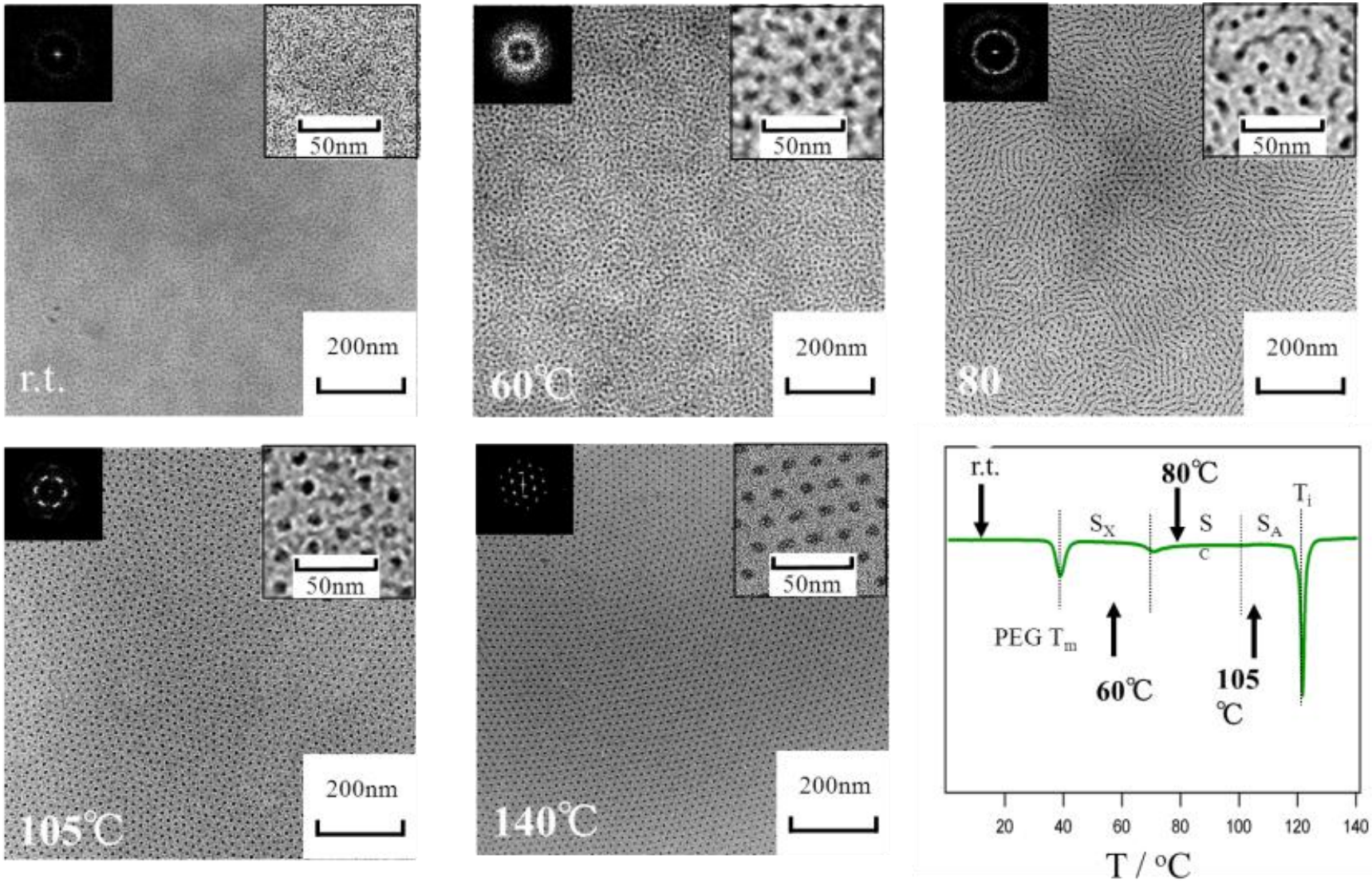


PEO_{114}-*b*-PMA(Az)$_m$



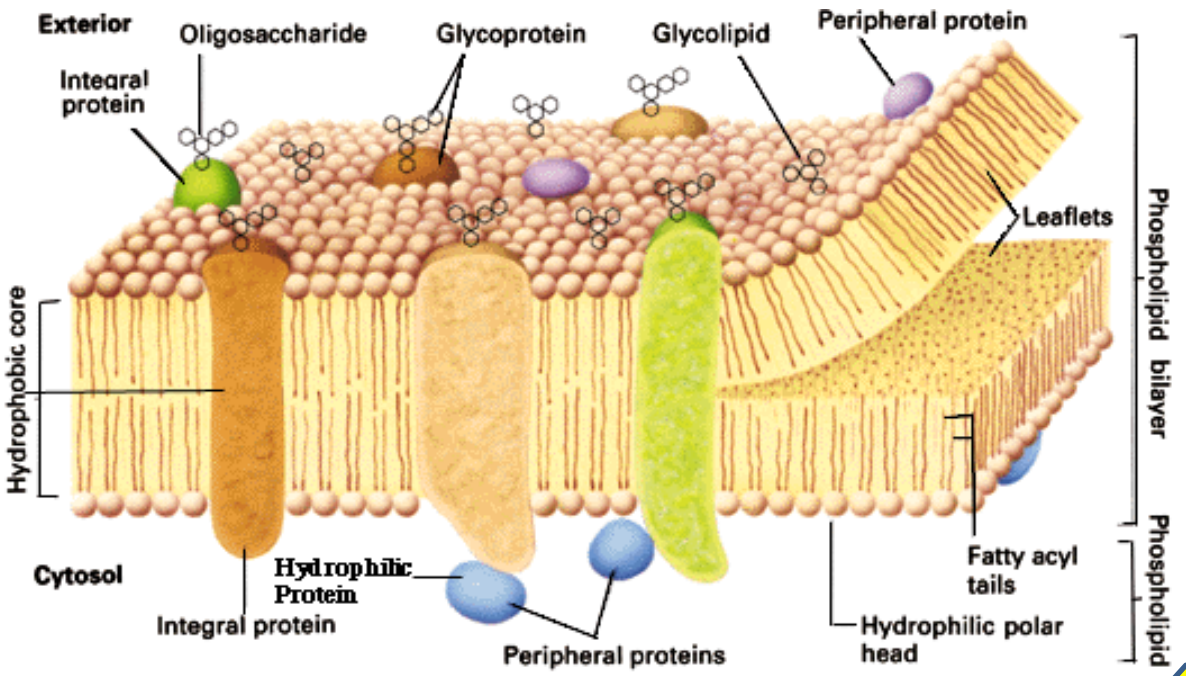
PEO_{114}-*b*-PMA(Stb)$_m$

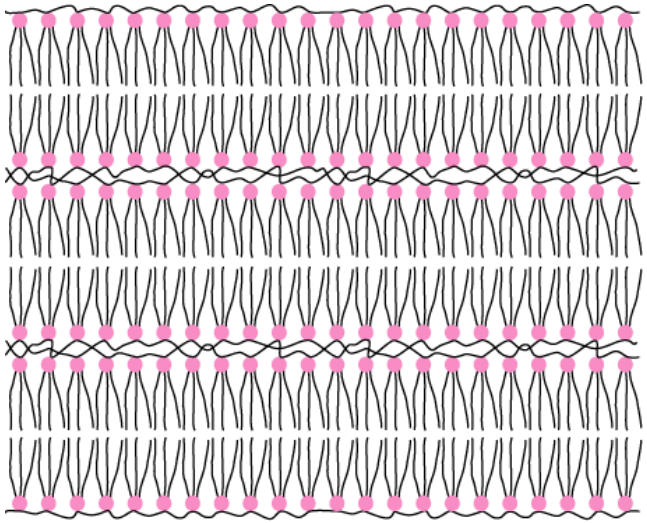
PEO_m-*b*-PMA$(Az)_n$：相分離構造秩序



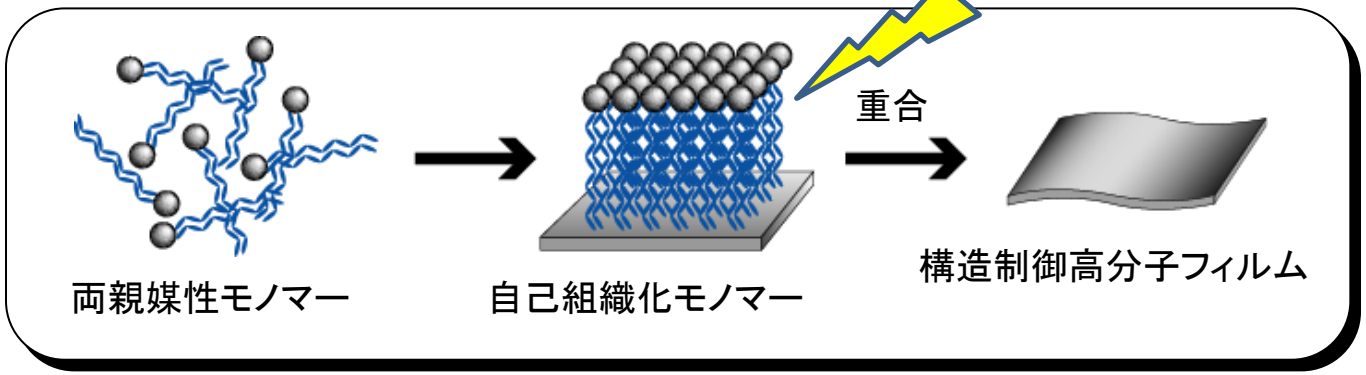
両親媒性を利用した自己組織化重合

分子積み木

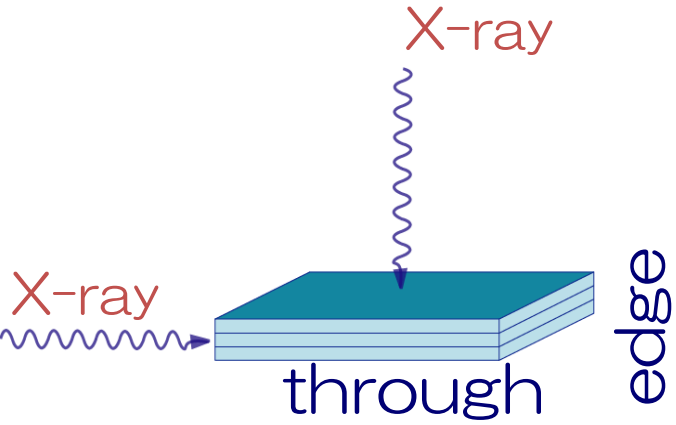


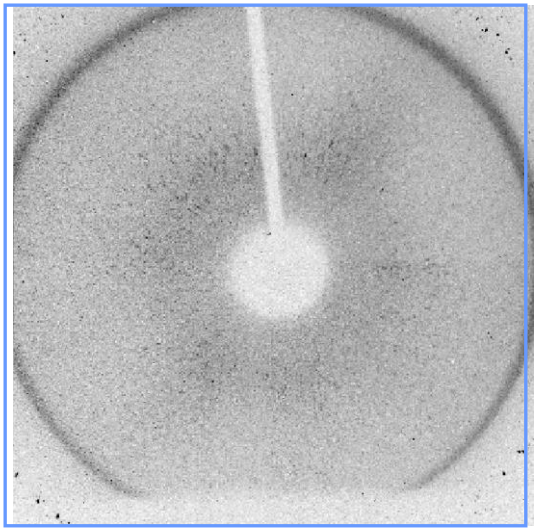


低エネルギー電子線、X線

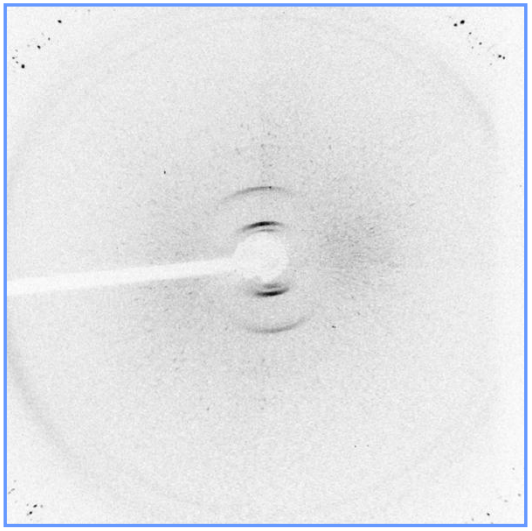


二分子膜型高分子センサー



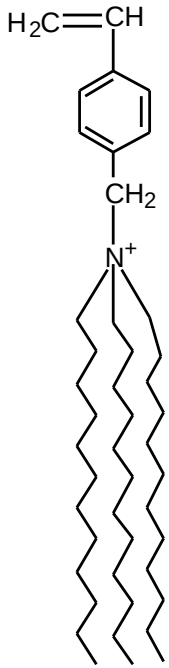


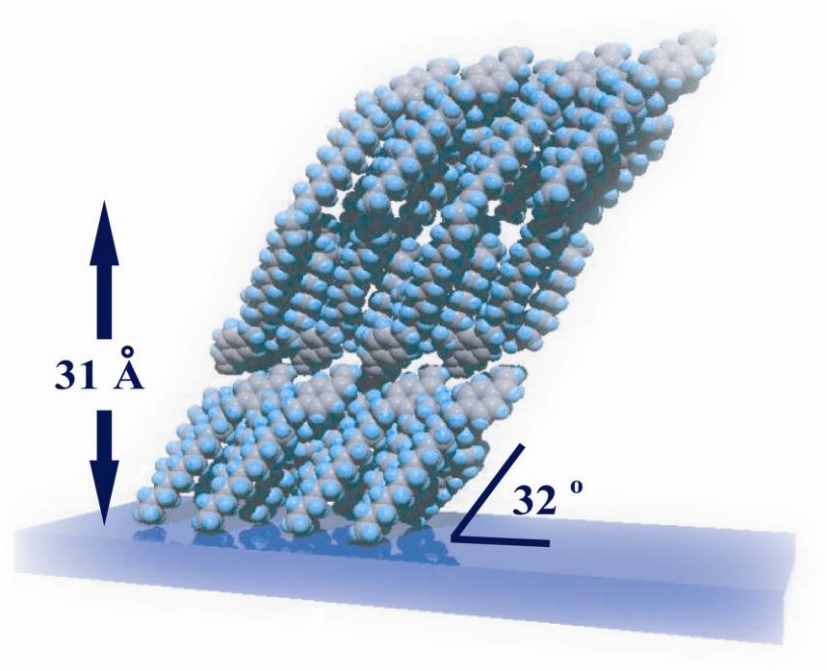
edge



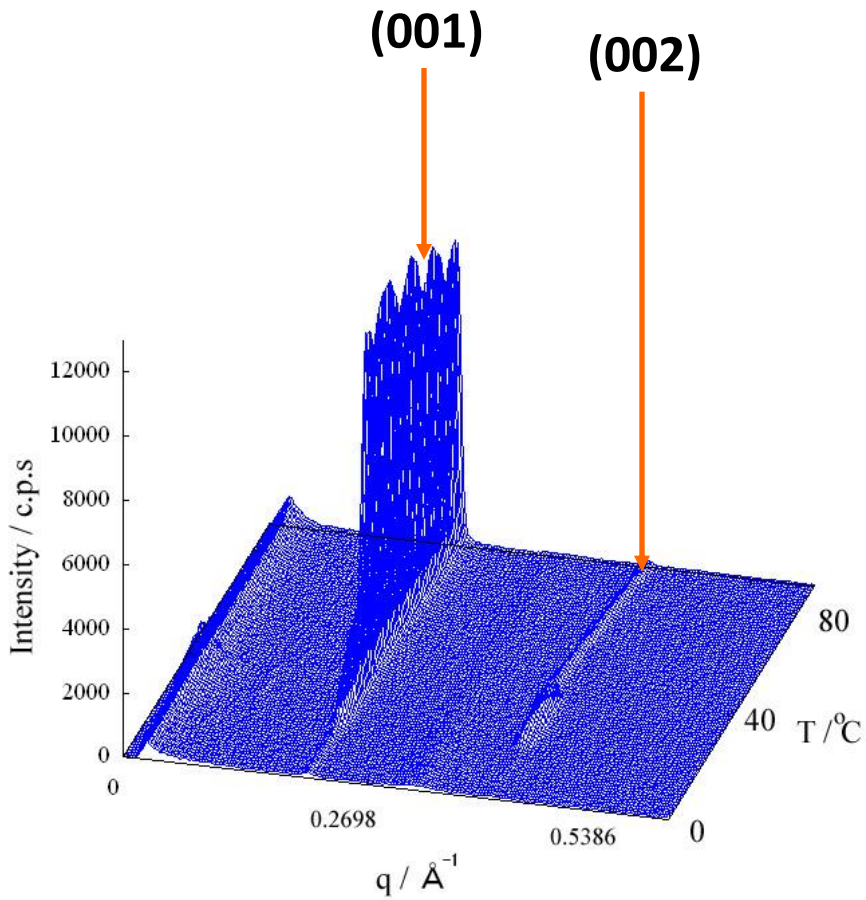
塩化物イオンセンサー

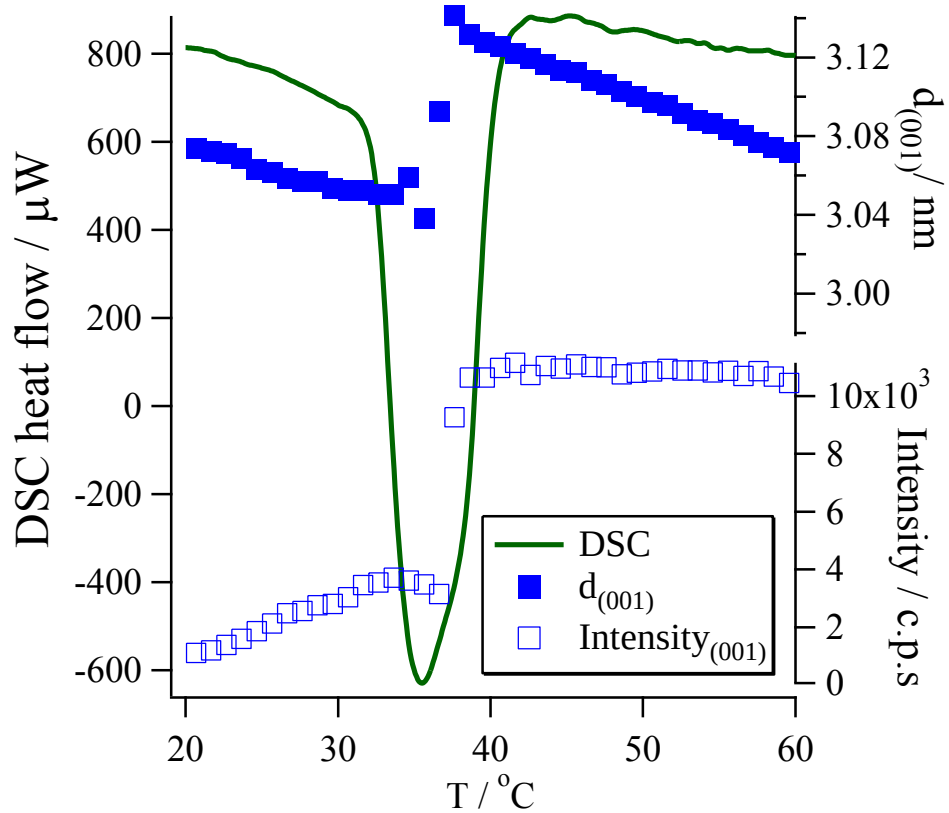
- 理論感度の98%
- 耐久性　10^4回
  感度　90%
  応答性 95%
- 高選択性

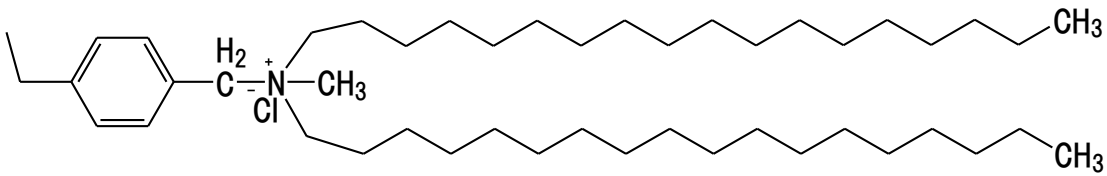




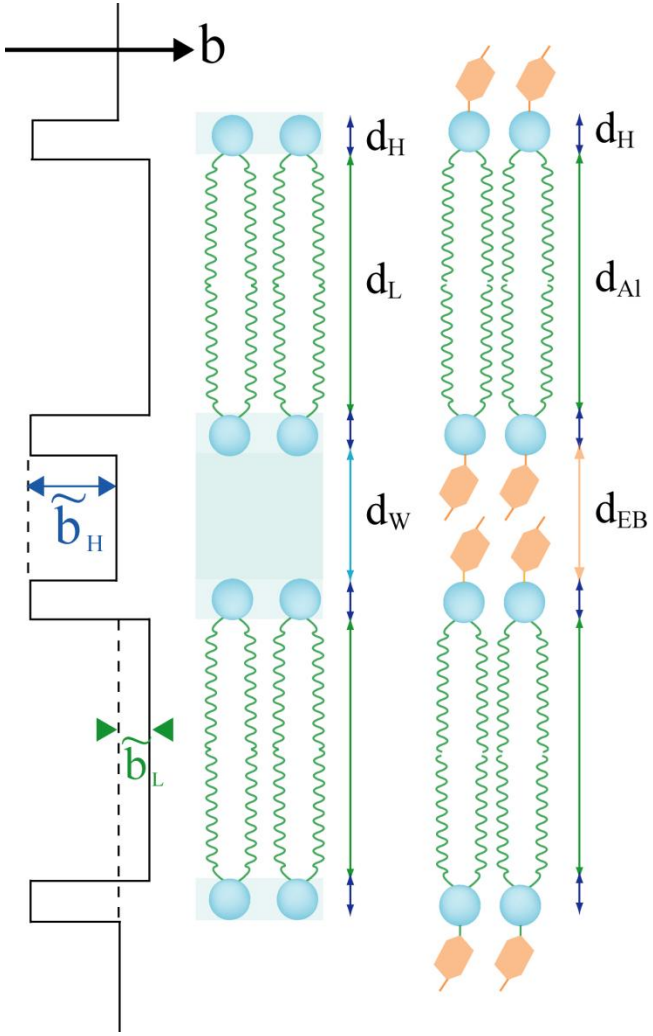
重合過程の構造解析：DSC-SAXS



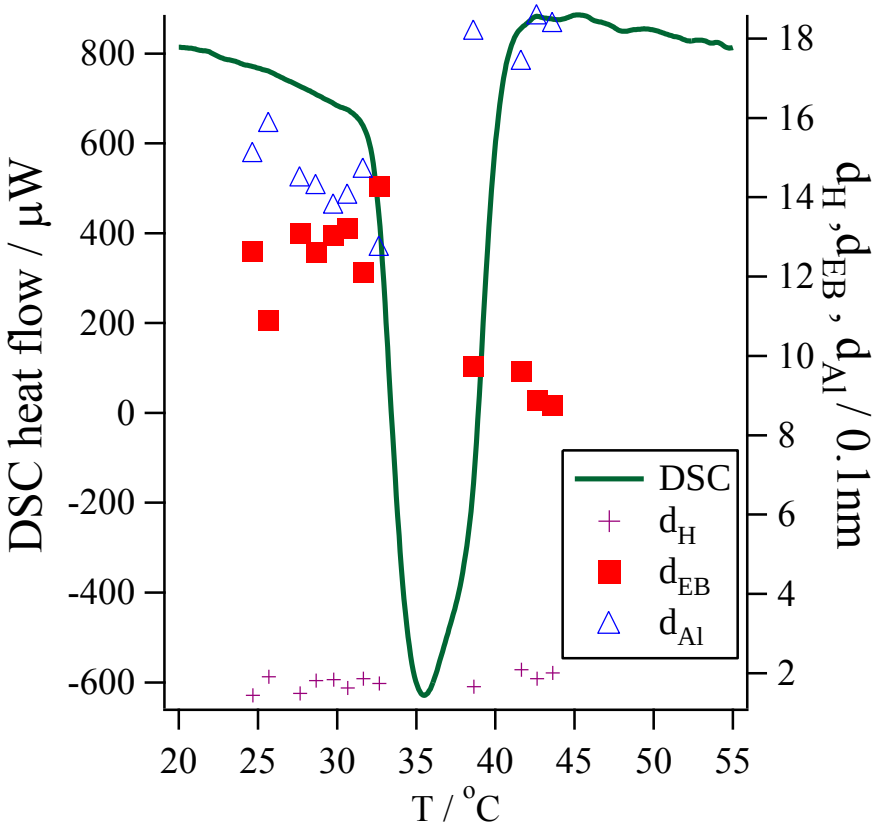




重合過程の構造解析：DSC-SAXS

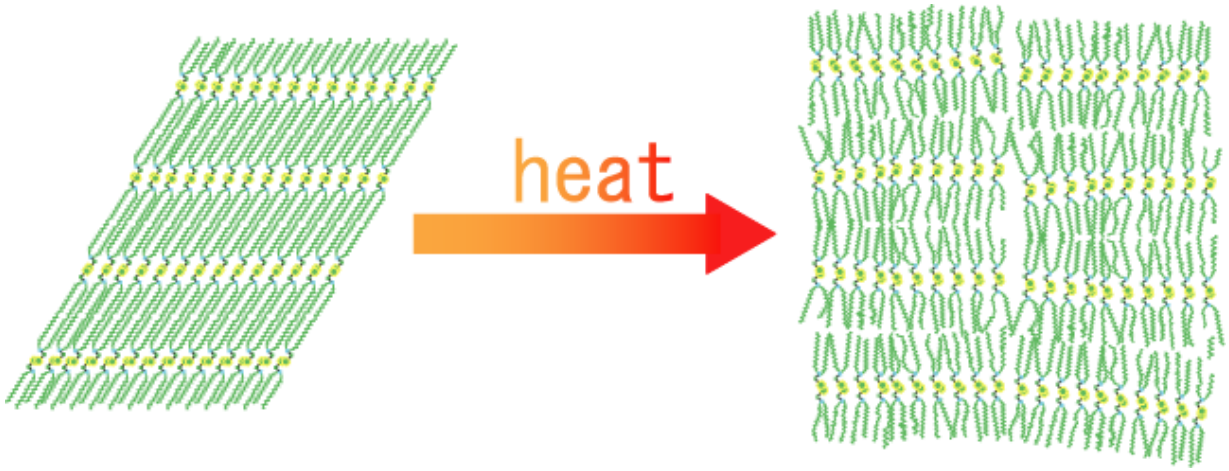


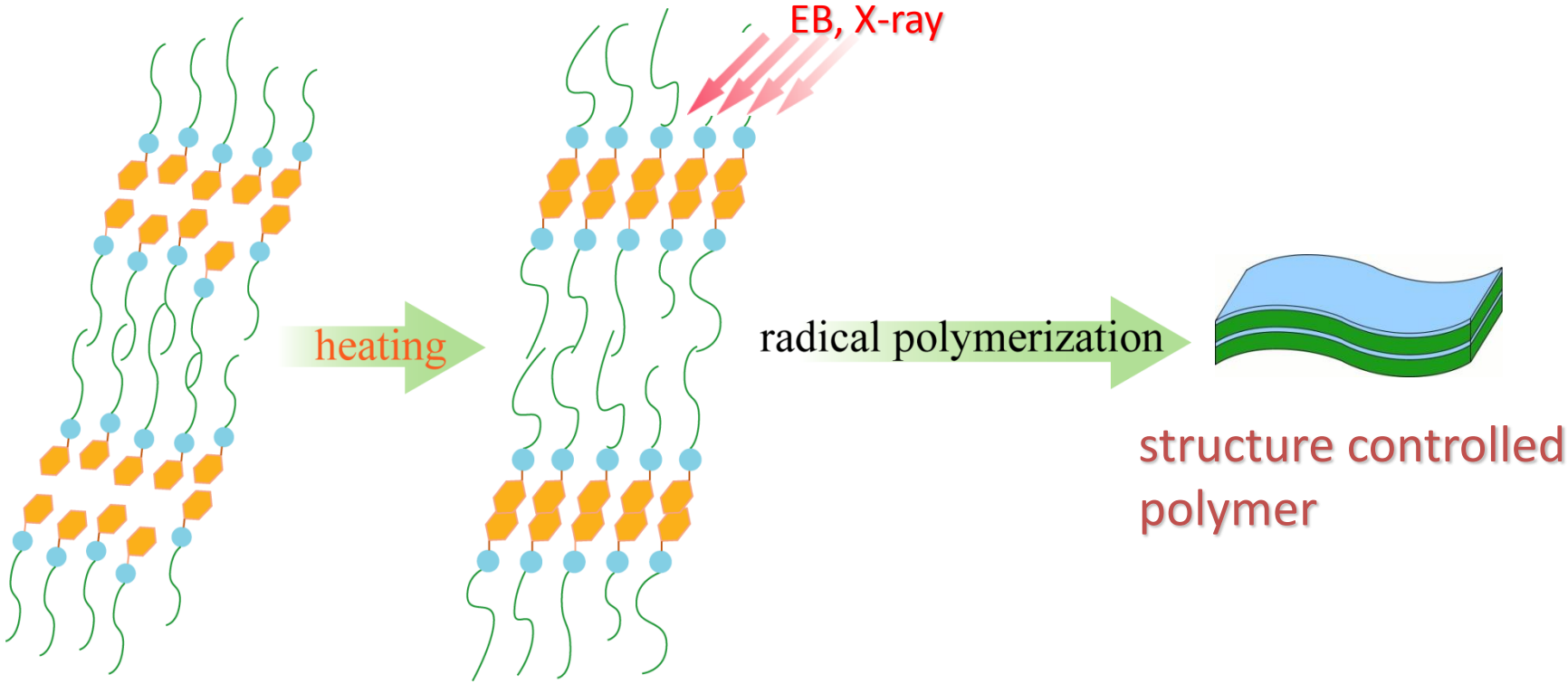
電子密度プロファイル



重合部位とアルキル鎖のゆらぎ

スメクチック相で重合


heat


EB, X-ray
heating
radical polymerization
structure controlled
polymer

同時測定法

マクロな特性

熱分析
DSC

熱容量
状態
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構造
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