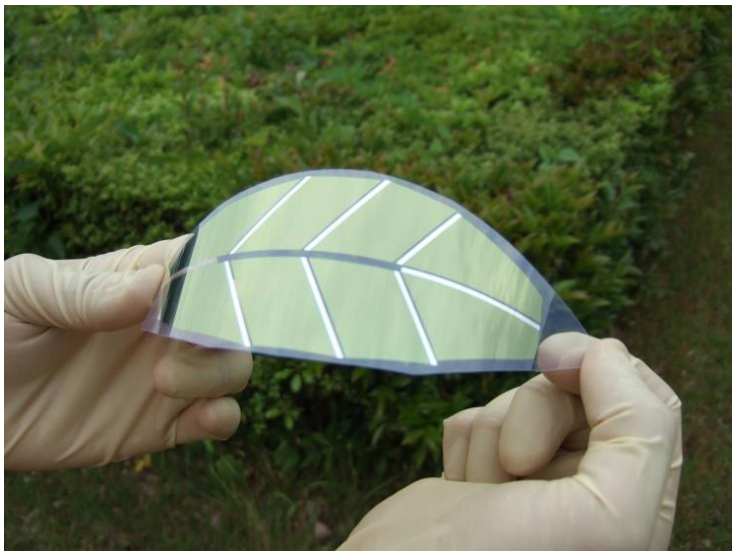
有機薄膜太陽電池の結晶成長制御

宮寺哲彦
有機系薄膜チーム

有機薄膜太陽電池（OPV）

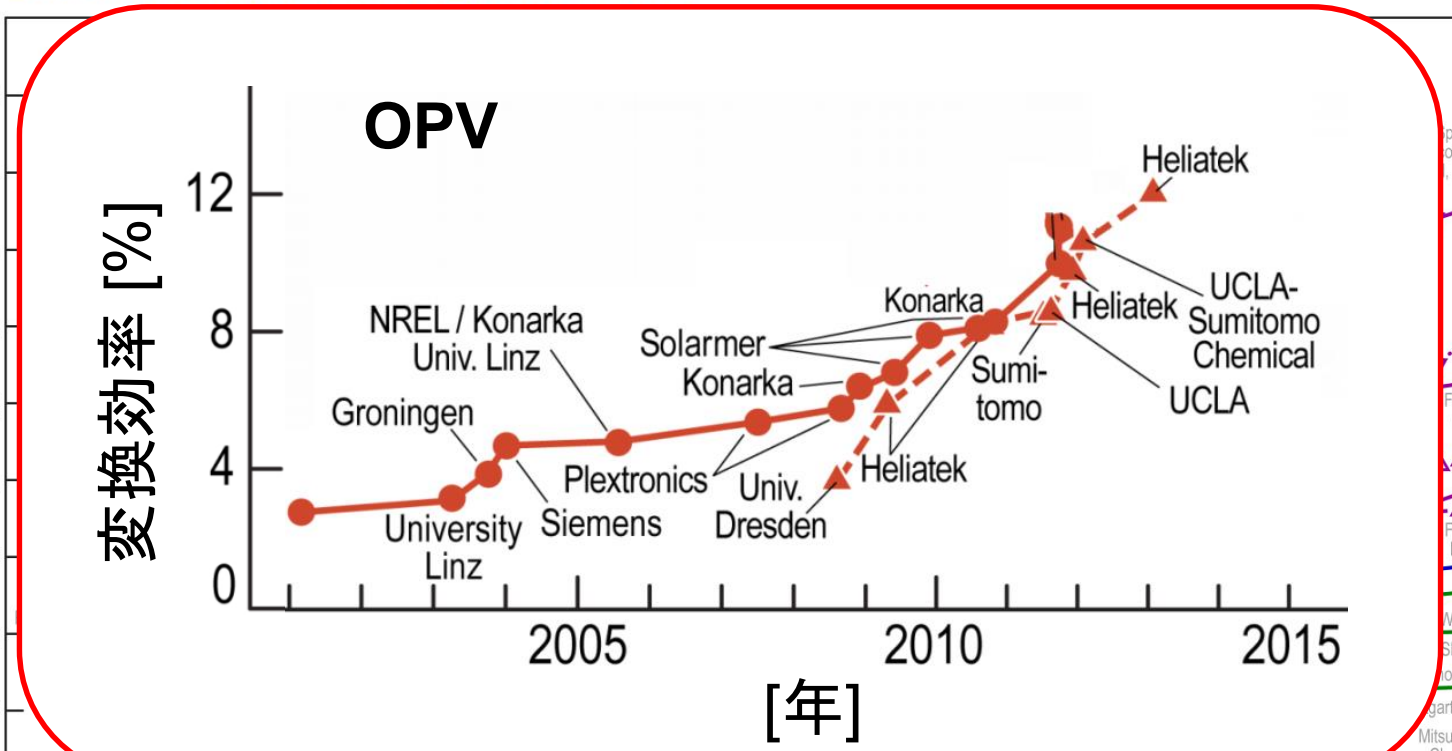
低コスト・フレキシブル・意匠性



TOKI　Mitsubishi Corporation　National Institute of Advanced Industrial Science and Technology AIST

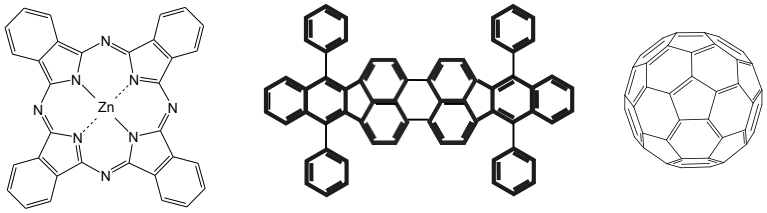
Best Research-Cell Efficiencies

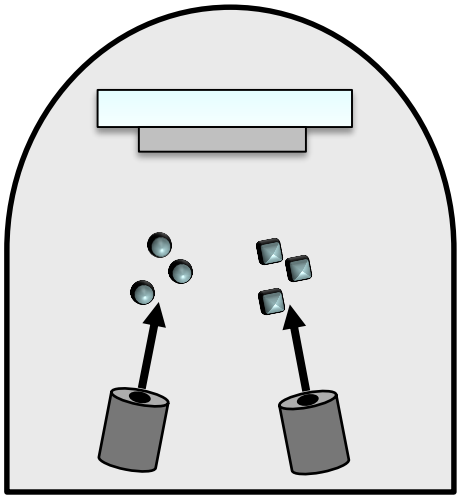
NREL
NATIONAL RENEWABLE ENERGY LABORATORY



素子作製方法

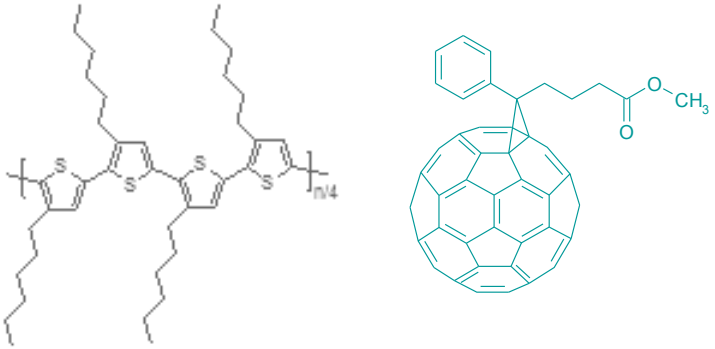
低分子系有機半導体

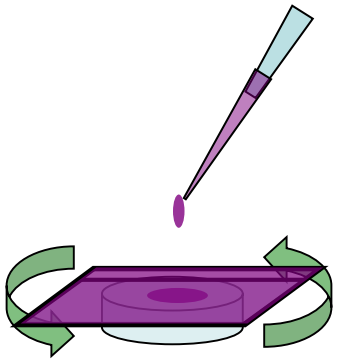




真空蒸着で作製

高分子系有機半導体

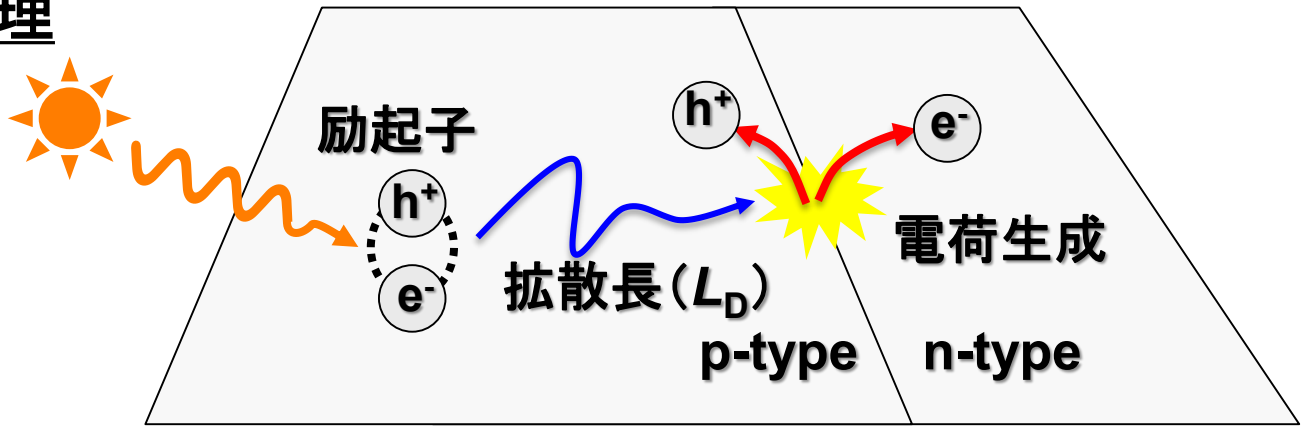




スピンコートで作製

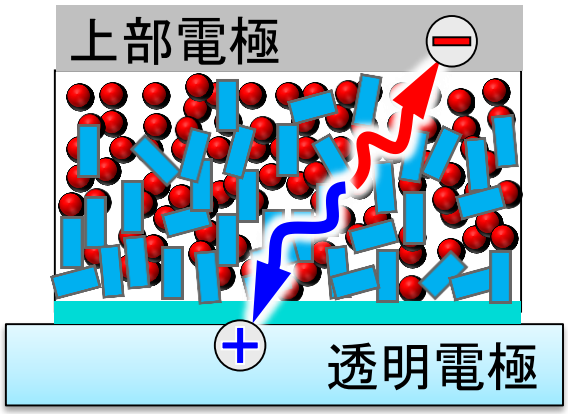
素子特製の律則要因

発電原理

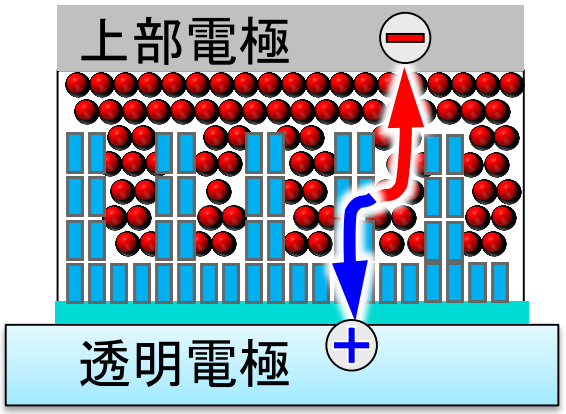


バルクヘテロジャンクション（BHJ）

現行の構造



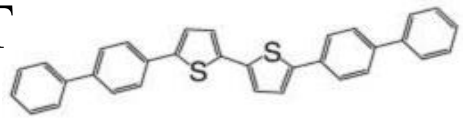
理想的な構造



自己組織化テンプレート層

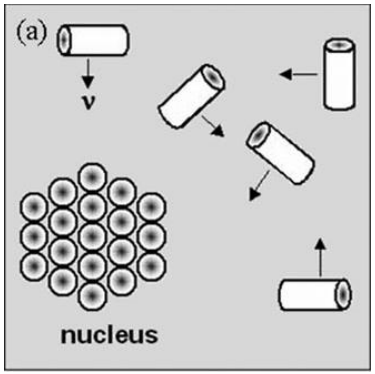
バッファー層

BP2T

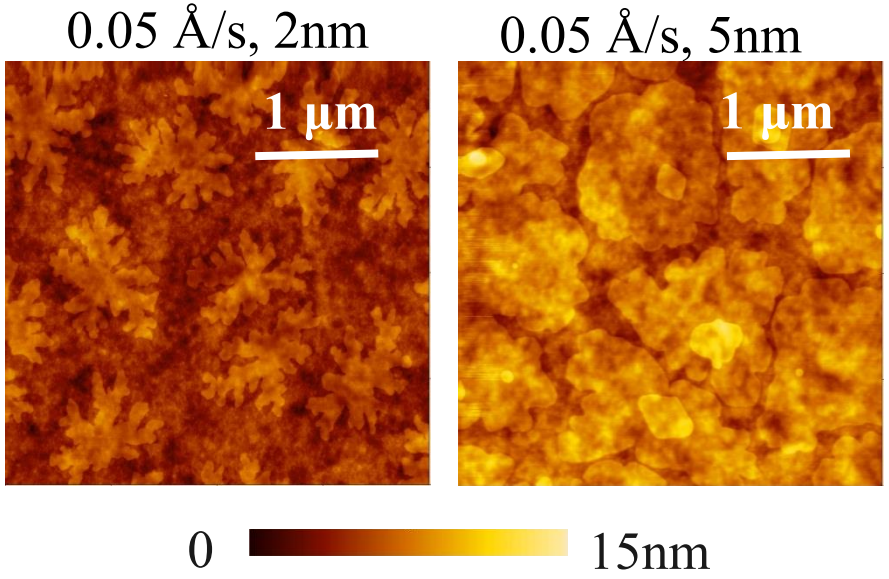


2,5-bis(4-biphenylyl)bithiophene

自己組織化して規則構造を形成

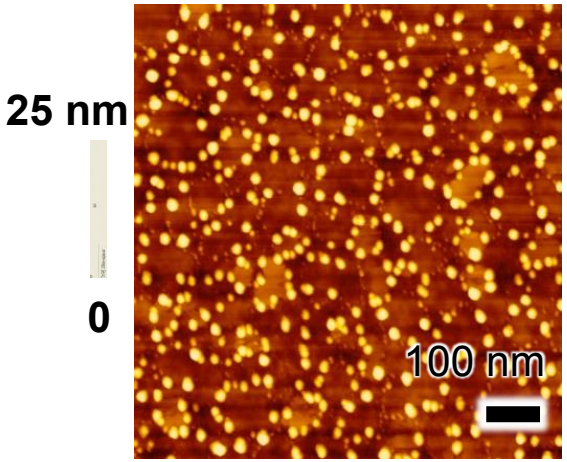


Chem. Soc. Rev. **38**, 2634 (2009).

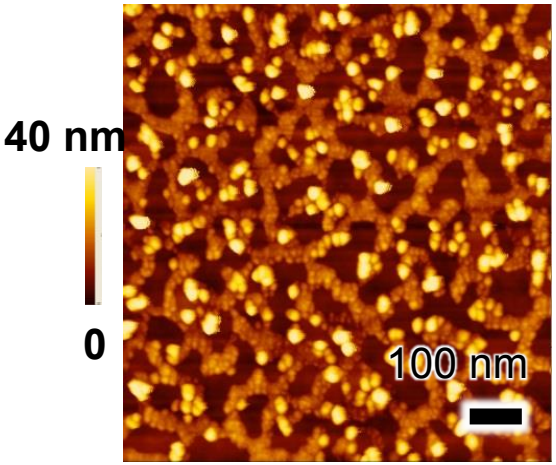


BP2T上への共蒸着

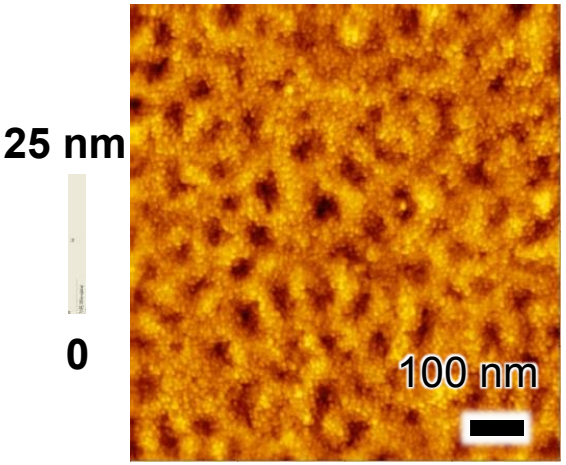
膜厚 2 nm

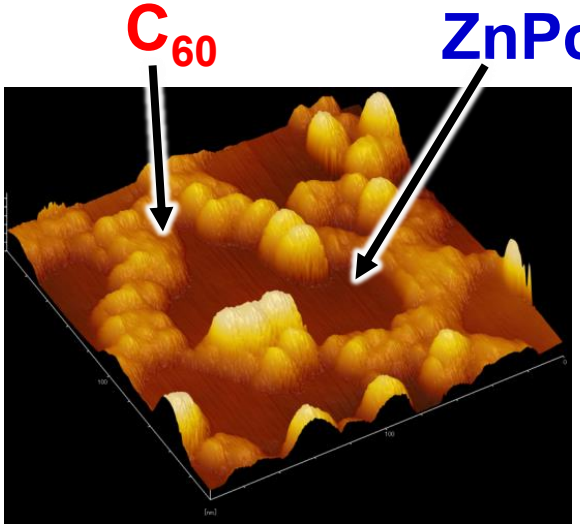


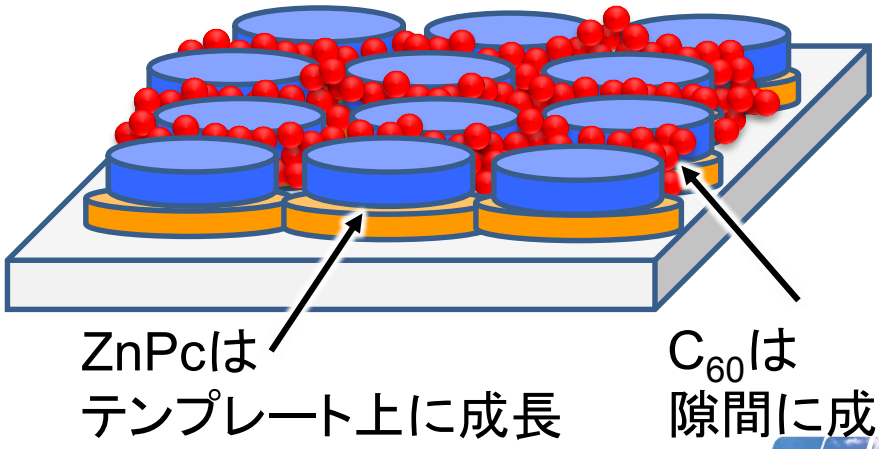
膜厚 10 nm



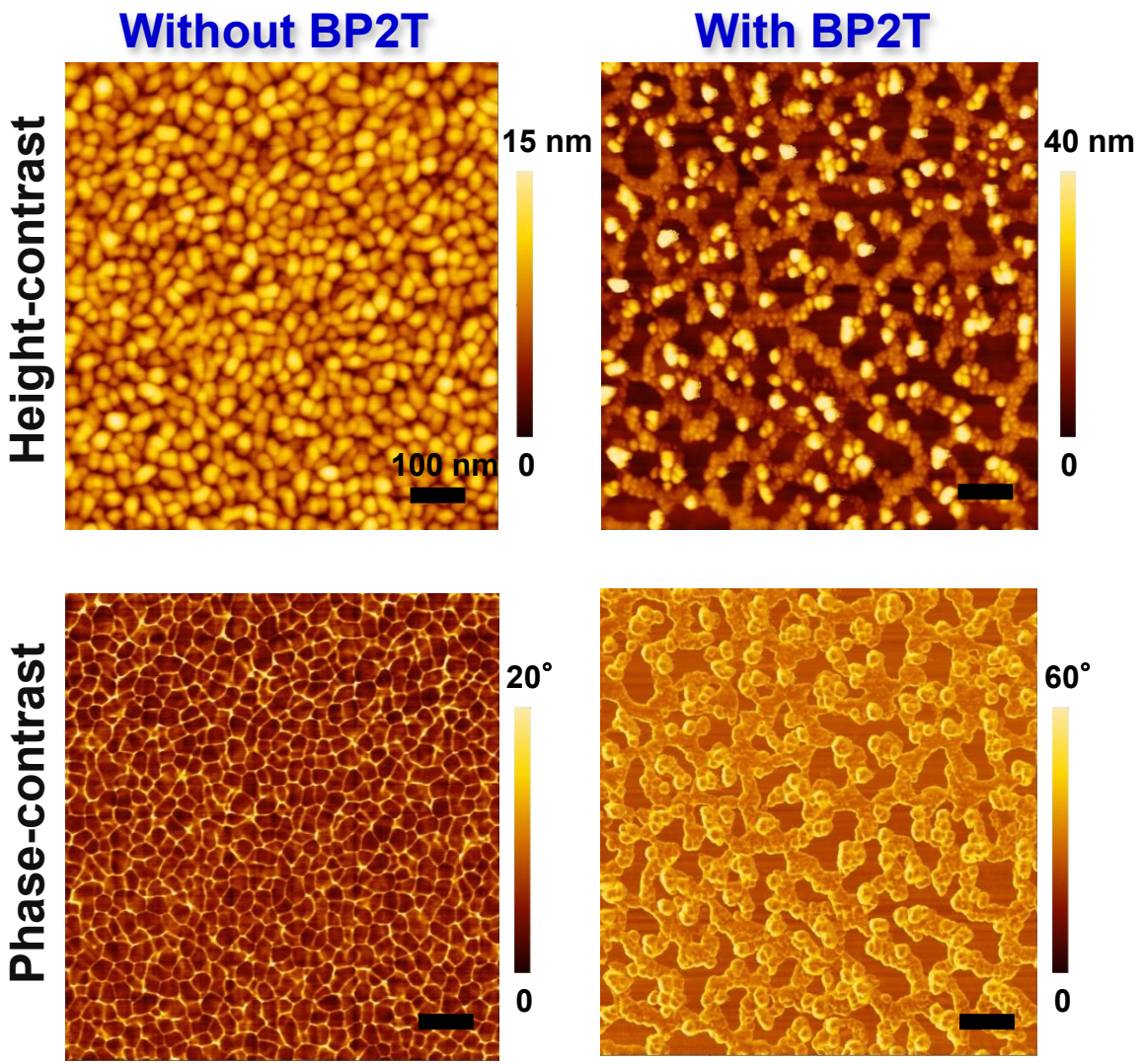
膜厚 40 nm

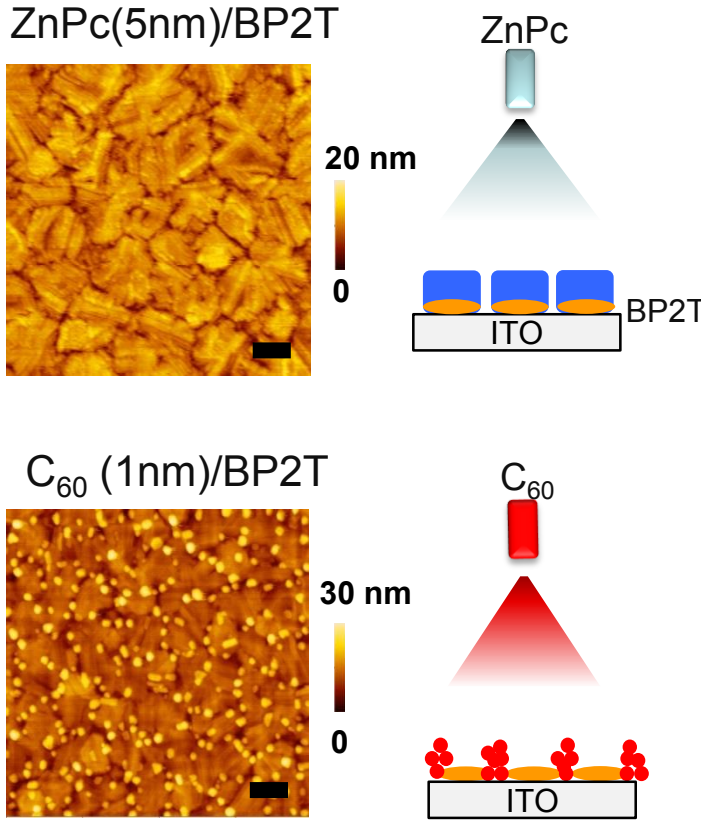




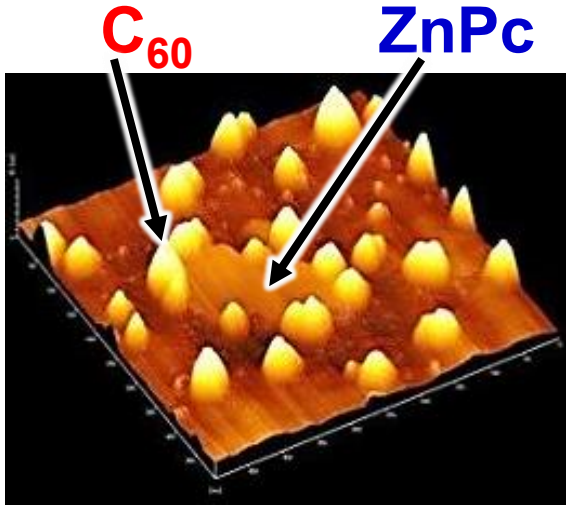


相分離構造のAFM観察

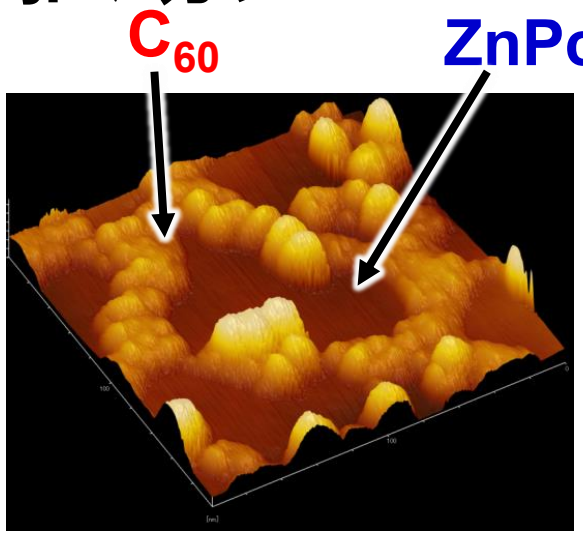




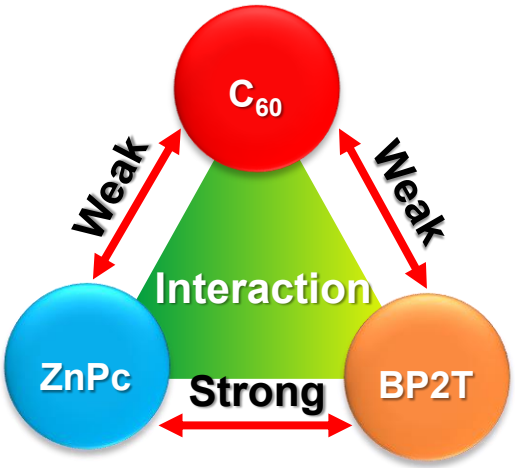
相分離の駆動力

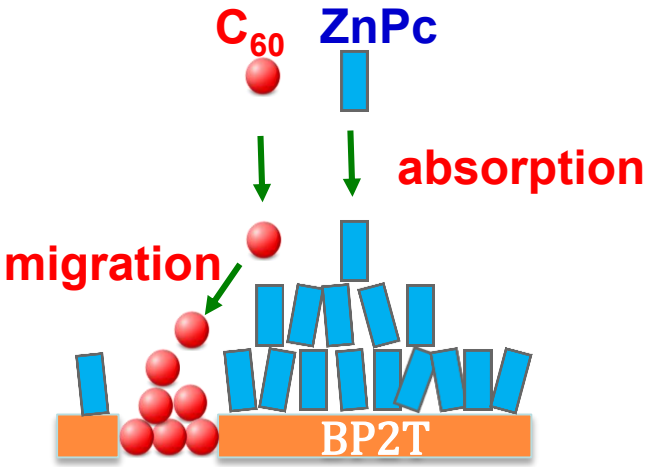


膜厚 2 nm



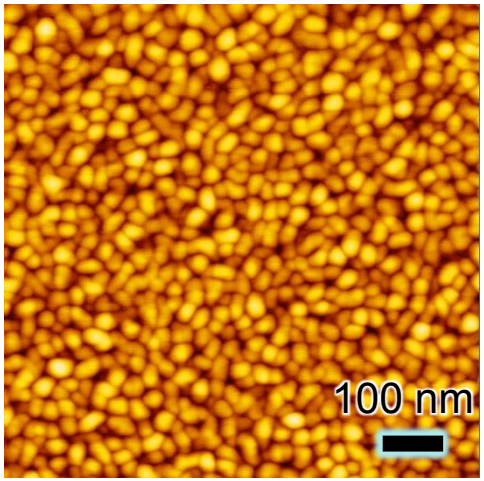
膜厚10 nm



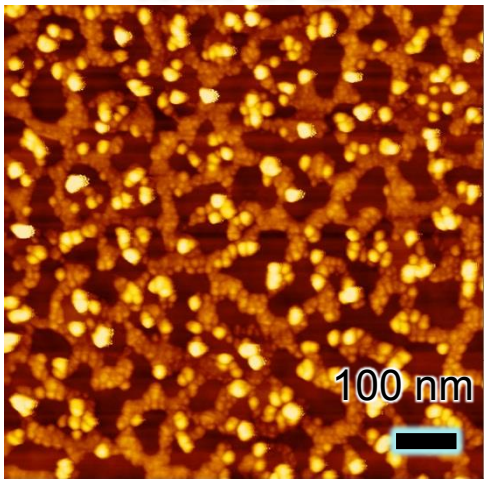


相分離膜の結晶性

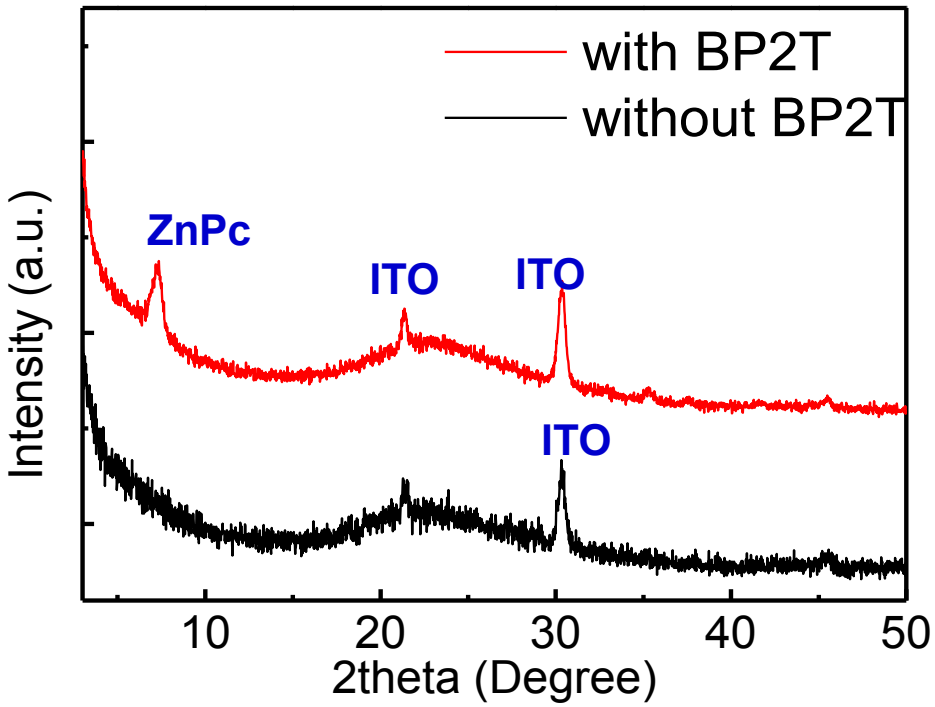
Without BP2T



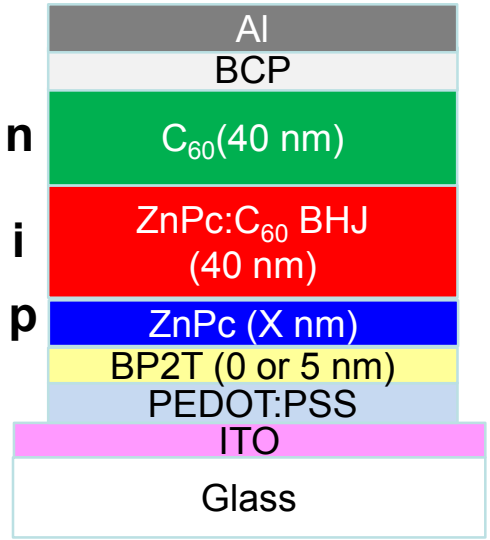
With BP2T

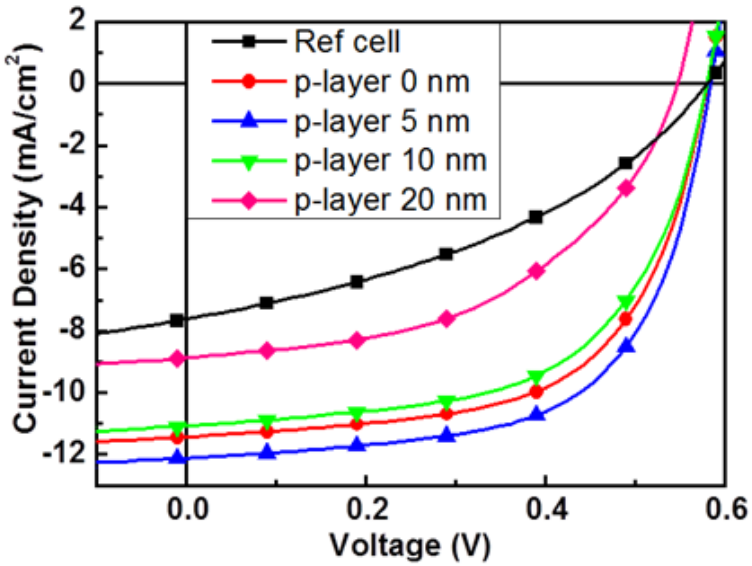


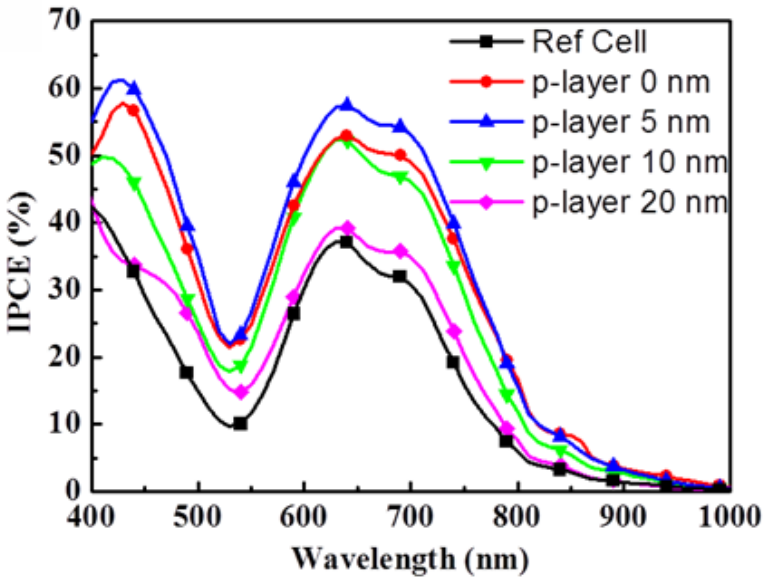
相分離構造
高結晶性
} 同時に達成



太陽電池特性







Cells	PCE (%)	Jsc (mA/cm^2)	Voc (V)	FF
No BP2T	1.85	7.58	0.58	0.42
ZnPc(0 nm)	3.93	11.46	0.58	0.59
ZnPc(5 nm)	4.15	12.13	0.58	0.59
ZnPc(10 nm)	3.66	11.05	0.58	0.57
ZnPc(20 nm)	2.39	8.84	0.55	0.49

まとめ

有機ヘテロエピタキシー

共蒸着の構造制御
- ドナー／アクセプター相分離
- 高結晶性

制御された薄膜構造によって特性向上