Preparation of Relaxor Ferroelectric Polymer Langmuir-Blodgett Films Assisted by Polymer Nanosheets

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Introduction

Polymer relaxor ferroelectric (RFE) behavior such as narrow hysteresis loop with low remnant polarization and high saturation electric field has attracted a great deal of attention for their excellent application potentials in high energy storage.[1] Poly(vinylidene fluoride-trifluoroethylene-chlorotrifluoroethylene) [P(VDF-TrFE-CTFE)] (Fig. 1A) is a typical relaxor ferroelectric polymer, in which the third unit CTFE with large size and low dipole moment is incorporated as defects to physically confine the ferroelectric domain size into nanoscale to achieve RFE structures. In terms of physical pinning force, the Langmuir-Blodgett (LB) technique has been used for preparation of PVDF nanofilms with tunable thickness assisted by amphiphilic poly(*N*-dodecylacrylamide) (pDDA) nanosheets (Fig. 1A).[2] Moreover, since pDDA barely has polarity, the physical confinement for interlayers as well as adjacent PVDF nanodomains is expected. Herein, preparation of P(VDF-TrFE-CTFE) LB nanofilms with the aid of pDDA nanosheets will be introduced.

Results and discussion

Surface pressure (π) – area (A) isotherms of P(VDF-TrFE-CTFE): pDDA monolayers with various mixing ratios showed a sharp rise in surface pressure and high collapse pressures, indicating that high molar content of PVDF can form compact mixed LB films with a tiny amount of pDDA. Fig. 1B shows an FTIR spectrum of 80% P(VDF-TrFE-CTFE) mixed LB films (30 layers), elucidating that P(VDF-TrFE-CTFE) is successfully transferred onto substrates at the air–water interface. The long trans conformation (T_n) sequence is evidenced by the absorption at 848 cm^{-1} ($T_{>3}$), while no peak was observed at 1287 cm^{-1}, which is assigned to $T_{>4}$ sequence,[1] indicating that the T sequences in P(VDF-TrFE-CTFE) mixed films might be limited to less than four. The details of surface morphology and crystalline information will also be introduced in the presentation.

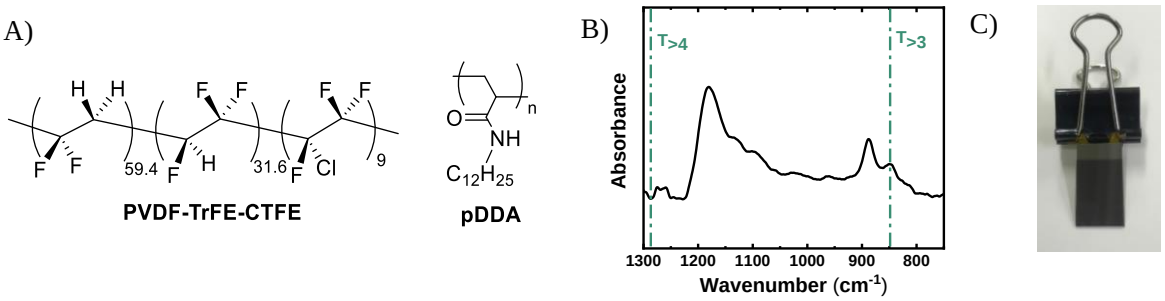

Figure 1. A) Chemical structures of pDDA and P(VDF-TrFE-CTFE) B) FT-IR spectrum and C) photograph of P(VDF-TrFE-CTFE) LB films (30 layers)

References

[1] L. Yang, B. A. Tyburski, F. D. Dos Santos, M. K. Endoh, T. Koga, D. Huang, Y. Wang, L. Zhu, Macromolecules **47**, 8119 (2014).

[2] H, Zhu, M. Mitsuishi, T. Miyashita, Macromolecules **45**, 9076 (2012).