

Surface Properties and Higher Ordered Structures in Perfluorinated Polymers: Layered Structure of Perfluoroalkyl Group and Periodic Lamellar Structure in the Block Copolymer

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Perfluoroalkyl (R_f) groups are well known for their excellent surface properties, such as hydrophobicity and anti-fouling behavior. The surface properties are enhanced discontinuously when the carbon number (n) of R_f chain becomes larger than 8. Among variable perfluoroalkyl compound, comb-shaped polymers with R_f side-chain are prospective materials because of the high processability by solution coating method. In particular, the comb-shaped polymers with the same poly(acrylate) backbone and short R_f side-chain with fewer than 7 carbon atoms are amorphous, while those with larger than 8 carbon atoms formed highl-ordered smectic structure. It means the surface properties are dominated not only the low surface-free-energy (chemical property) of the R_f groups but also the higher ordered structures [1]. Therefore, it is important to understand the ordered structure of R_f side-chains in the comb-shaped polymer for controlling the surface properties.

In this presentation, typical comb-shaped perfluorinated polymer, poly{2-(perfluorooctyl ethyl) acrylate} (PFA- C_8), is focused on and the higher ordered structures of PFA- C_8 in the homopolymer and the block copolymer with a main-chain liquid crystalline polyester (MCLCP) [2], both in the bulk and thin film state, will be discussed based on synchrotron (SR) X-ray scattering methods. SR X-ray analyses revealed that smectic layer of R_f groups epitaxially grew at the surface (air-interface). In the case of the block copolymer, complex morphologies (lamellar nano-structure) were observed in the thin film due to the orientation frustration between PFA- C_8 and MCLCP. The details will be discussed in the presentation.

References

- [1] Ishige *et al*, *Macromolecules*, **47**(12), 3860–3870 (2014).
- [2] Ishige *et al*, *Macromolecules*, **44**(12), 4586–4588 (2011).