

Poly(*N*-Isopropylacrylamide)を有するグラフト共重合体の物性研究

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Study on Property of Graft Copolymers with Poly(*N*-Isopropylacrylamide) (¹*Graduate School of Nanobio, Yokohama City University*) ○Mai Sasaki,¹ Hisashi Honda¹

PNIPAAm is one of temperature-responsive polymers. It has a lower critical solution temperature(LCST) at ca. 32°C in solution, and its interaction with water changes at this temperature. When the temperature is lower than LCST, it shows hydrophilicity and dissolves in water. Conversely, if the temperature is higher than LCST, it shows hydrophobicity and becomes insoluble. Based on the property, we propose a new cooling system. PNIPAAm absorbs surrounding water during cool nights and releases the water during hot days. Using the vaporization heat, it can reduce the room temperature. Zheng-Hong *et. al.* report a graft copolymer in which the main chain is constructed by methyl methacrylate (MMA) and the sidechain is formed by PNIPAAm, and reveal that the graft copolymer shows a phase transition at ca. 32°C which is the same temperature as LCST of PNIPAAm homopolymer¹⁾. However, the relationship between the amount of NIPAAm and water molecules has not been clarified enough. Therefore, the purpose of this study is to reveal the relationship using TG, DSC, and solid-state ¹H NMR methods. In this study, we prepared nine samples with different amount of NIPAAm. TG and DSC measurements were carried out the relationship of each sample with water. Molecular motion of samples was investigated by solid-state ¹H NMR measurements. Differences in swelling ratio and dehydration rate were recorded by the polymerization rate of NIPAAm.

Keywords: Poly(*N*-Isopropylacrylamide); Swelling ratio; Graft copolymer; Solid-state ¹H NMR

Poly(*N*-isopropylacrylamide)(Fig. 1)(以下 PNIPAAm と略す)は温度応答性高分子の一つで、32°C付近に下限臨界溶液温度 (Lower Critical Solution Temperature, 以下 LCST) を持つ。PNIPAAm は LCST より温度が高いときは疎水性、温度が低いときは親水性を示す。この性質を用いて

本研究室では PNIPAAm を用いて、温度の低い夜間に空気中の水分を吸着、温度の高い日中に吸着した水分を放出し、そのときに発生する気化熱により周囲の気温を低下させる新規冷却材料の研究を行っている。Zheng-Hongららは、塗料原料であるメタクリル酸メチル(以下 MMA)を主鎖、NIPAAm を側鎖として重合したグラフト共重合体を合成し、それらが PNIPAAm ホモポリマーの LCST と同温度で相転移することを示した¹⁾。しかし、合成されたグラフト共重合体における NIPAAm の重合比による分子の運動性や水との相互作用の関係などは十分明らかになっていない。そこで本研究では MMA と NIPAAm の重合比の異なるグラフト共重合体の合成を行い、それらの物性について TG や固体 ¹H NMR 測定などを行った。その結果、NIPAAm の重合度によって膨潤率や脱水速度に違いが見られた。

1) Jin-Jin Li, Yin-Ning Zhou, Zheng-Hong Luo, *Polymer*, **2014**, 55, 6552.

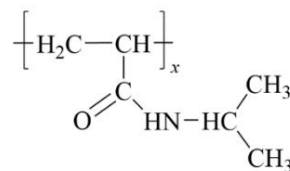


Fig. 1 Chemical Structure of PNIPAAm