

高分子学会九州支部 外国人講演会

Physical Gelation and Spinodal Temperature of Poly(*N*-isopropylacrylamide) in Water

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場所：鹿児島大学郡元キャンパス 工学系講義棟 123 講義室

Abstract:

In our previous paper, we have shown that the physical gelation of a-PNIPAM aqueous solution occurs at a gel temperature (T_{gel}) lower than the binodal temperature (T_b). T_{gel} is determined from the Winter–Chambon criterion based on rheological data obtained from isothermal frequency sweep, whereas T_b is obtained from the cloud point extrapolated at a zero-heating rate on heating the one-phase solution from 15°C. Considering that $T_{\text{gel}} < T_b$ for the present aqueous solutions of a-PNIPAM with 5–12 wt% concentration, the derived T_b is strictly considered as the binodal temperature for the a-PNIPAM macroscopic gel and not for the a-PNIPAM solution. This study applied time-resolved light scattering (TRLS) to explore the structure evolution of the transparent gel at T_i ($T_{\text{gel}} < T_i < T_b$). In addition, via the subsequent T-jump from T_i to some selected temperatures T_x 's ($\geq T_b$), the TRLS intensity profiles of the phase-separated PNIPAM gel were also acquired till the steady state was reached, at which the phase-separated structures, induced either by nucleation and growth (NG) or by spinodal decomposition (SD), were finally pinned. At each T_x , the scattered intensity profiles of a-PNIPAM gels with either pinned NG or pinned SD structures were further analyzed to obtain the scaled structure factor $F(x)$. Judging from the T_x -dependent $F(x)$ profiles, a novel approach is proposed to determine the spinodal temperature ($T_{\text{s,gel}}$) of the macroscopic gel. For the well-characterized 7 wt% PNIPAM aqueous solution with $T_b = 30.6$ °C and $T_{\text{gel}} = 27.6$ °C, the TRLS intensity profile of the macroscopic gel at $T_i (= 29.2$ °C) exhibits a mass-fractal dimension of 2.0 ± 0.1 . The derived $T_{\text{s,gel}}$ by TRLS in this study is 31.2 ± 0.1 °C, which is in good agreement with that derived previously from small-angle X-ray scattering based on the Ornstein–Zernike scattering function. An extremely small temperature gap (~ 0.6 °C) exists between T_b and $T_{\text{s,gel}}$ for the specific PNIPAM/H₂O hydrogels studied.

申込先

1) 参加費：無料、2) 定員：50 名、3) 申込方法：氏名、所属、連絡先を明記の上、E-mail にてお申込みください。4) 申込締切：2025 年 7 月 2 日（水）

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