HOKKAIDO UNIVERSITY

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Doctoral Dissertation Evaluation Review

Degree requested Doctor of Soft Matter Science Applicant's name: HAN Yang （韓 陽）

Examiner :

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Title of Doctoral Dissertation

Study on Synthesis and Properties of Thermo-Responsive Lamellar Hydrogels
（熱応答性層状ハイドロゲルの合成と特性に関する研究）

Results of Evaluation of the Doctoral Dissertation (Report)

Various temperature-responsive photonic gels have already been reported. However, existing photonic gels often have difficulty controlling the structural color in the reference state. Besides, existing temperature-responsive photonic gels often show slow continuous structural color changes in response to temperature variations.

In this work, the author performed research on synthesis of thermo-responsive lamellar hydrogels using poly(*N*-isopropylacrylamide) (PNIPAM) as the thermo-responsive component to incorporate into the soft layer of poly(dodecyl glyceryl itaconate)/polyacrylamide (PDGI/PAAm) lamellar hydrogels to form PDGI/PAAm-PNIPAM hydrogels with unique thermo-responsive optical and swelling properties.

Compared to existing temperature-responsive photonic gels, the thermo-responsive lamellar PDGI/PAAm-PNIPAM hydrogel has the following advantages and features.

The structural color of this gel at low temperatures can be controlled in the green-to-red range, depending on the amount of PNIPAM introduced. Wider color control might be achievable through structural modifications of the PDGI/PAAm hydrogels used as templates. The gels not only exhibit reversible deswelling/reswelling but also permit structural color, turbidity, and swelling anisotropy tunable by temperature and PNIPAM density. Notably, the gel exhibits an ultrafast and reversible structural color/turbid transition around the LCST, which represents a unique approach in smart window technology. In contrast, this system shows a color/monochrome transition at the LCST of PNIPAM, taking less than 1 s for the change. In addition, temperature-responsive regions can be selectively introduced into this gel to visualize various information. Moreover, the structural color change of this system is reversible and stable. These new lamellar gel hold promise for various applications, including drug delivery, smart displays, and smart windows.

In conclusion, the author has made a novel contribution to functional hydrogels by successfully synthesized thermo-responsive lamellar hydrogels and studied their properties, and these hydrogels have potential applications in various fields.

Therefore, we acknowledge that the author is qualified to be granted a Doctorate of Soft Matter Science from Hokkaido University.