

DEVELOPMENT OF SELF-CONTROLLED COATINGS FOR SPECTRAL REFLECTANCE USING PNIPAM GELS

Takumi Takahashi¹, Hiroki Tomori¹, Hiroki Gonome^{1*}

¹Yamagata University, 4-3-16 Jonan, Yonezawa, Yamagata, Japan

Reducing carbon dioxide emissions is necessary to mitigate the increasingly serious effects of global warming. Cooling and heating consume a high percentage of the energy used in daily life [1]. Therefore, reducing the energy used for cooling and heating will lead to a reduction in carbon dioxide emissions.

Near infrared radiation accounts for about 50% of solar energy and raises the temperature of buildings as solar radiation heat. By switching the absorption and reflection of this light, it is possible to control the solar heat recovery of exterior wall materials without changing the appearance of the object. This research aims to develop materials that can reduce cooling and heating loads by controlling of spectral reflectance in different environments. The goal is to realize buildings that are warmer in winter and cooler in summer. A functional coating was developed using a temperature-sensitive gel as the matrix. The temperature-sensitive gel swells at low temperatures and shrinks at high temperatures. This makes it possible to produce functional coatings that can self-control the spectral reflectance under different temperatures.

In fact, functional coatings were prepared by adding copper oxide particles to PNIPAM gel. To evaluate the performance of the functional coatings, the ambient temperature was varied and optical measurements were made using a spectrophotometer (Figure 1.). The optical measurements show that the spectral reflectance changes with thermal contraction of PNIPAM gels. At low temperatures, the copper oxide particles reflect the light. At high temperatures, the reflectance depends on the reflectance of the substrate due to the thinning of the PNIPAM gels. This suggests that the reflectance could be varied, autonomously.

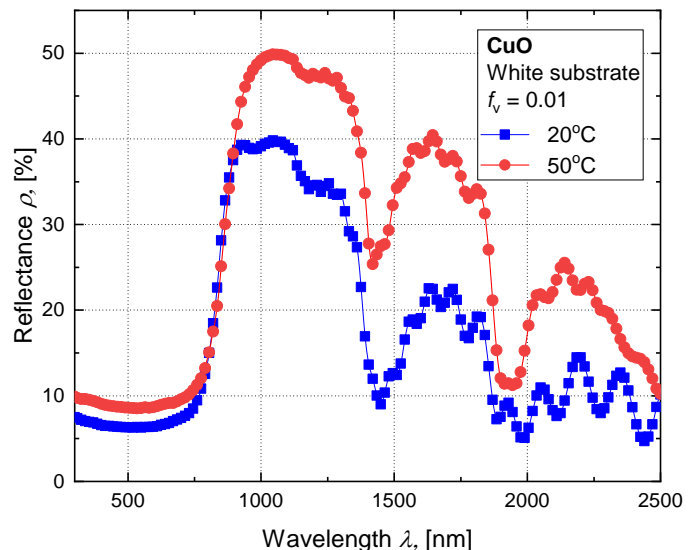


Figure 1. Variation of spectral reflectance at various temperatures

Reference

- [1] X. Cao, X. Dai, J. Liu, "Building energy-consumption status worldwide and the state-of-the-art technologies for zero-energy buildings during the past decade", *Energy and Buildings*, vol.128, pp.198-213, 2016.

* Corresponding Author: gonome@yz.yamagata-u.ac.jp