プラズマ処理した CNT 複合ポリウレタン薄膜の耐摩耗性向上の調査

Investigation of Wear-resistance Improvement of Plasma-treated CNT Composite Polyurethane Film

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1. Introduction

Carbon nanotubes (CNTs) are often functionalized in order to increase its chemical flexibility. The utilization of plasma is one of the functionalization methods[1], which enables the process with dry chemistries rather than that with wet chemistries. We have so far investigated how plasma-treated CNTs affect the mechanical property of organic-polymer in making CNT composite films.[2] Our former work showed that the composite polyurethane (PU) film mixing with plasma-treated CNTs increases the wear-resistance. In particular, the CNTs exposed with the plasma made of nitrogen (N_2) and carbon dioxides (CO_2) affects the improvement of wear-resistance the best. According to this processing condition, we concluded that this improvement was possibly due to isocyanate group (-NCO) which generally works to harden PU. In this presentation, we made the series of experiments to identify the isocyanate groups attached on plasma-treated CNTs with photoluminescence (PL) method to find that the improvement of wear-resistance was due to the groups.

2. Experimental Result

Fig. 1 shows PL spectra from the CNTs that were exposed to an organic isocyanate indicator, acridine yellow (AY, $C_{15}H_{15}N_3$). As seen in the figure, only the CNTs treated with N_2 and CO_2 plasma showed a wide peak from 500 to 630 nm. The result in this experiment indicates that the CNTs treated with the plasma possibly functionalized CNTs with isocyanate group, which might have increased wear-resistance of PU film.

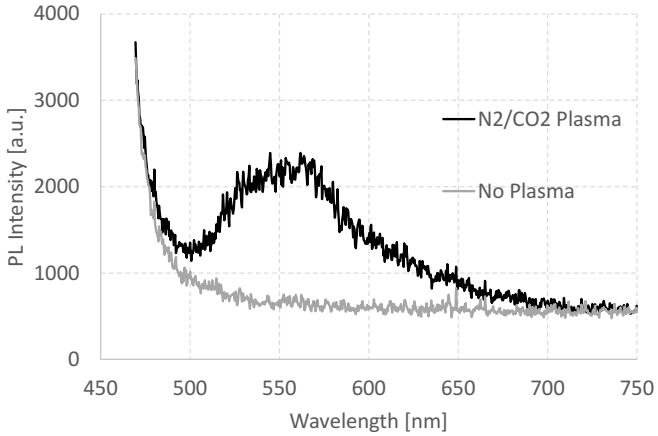

Fig. 1 PL spectrum from the CNTs treated with 1) plasma made with gas mixture of N_2 and CO_2 and 2) no plasma exposure.

References

[1] G. Kalita et al., *Current Appl. Phys.* **9** (2009) 346 – 351.

[2] D. Ogawa et al., *Jpn. J. Appl. Phys.* **55** (2016) 01AE22.