BAPVC Annual Project Report

Project Title: Composite encapsulation layers
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Summary:

We are setting up an in-house WVTR measurement system, and have obtained preliminary results, using our encapsulating materials (composite of PS-P2VP block copolymer and MgO nanoparticles). Also, we are exploring another type of composite encapsulating layer, with commercially available base materials, to improve the property and processability. The basic idea is similar to the current system, incorporating hygroscopic inorganic nanoparticles into laminate copolymers. The hydrophobic copolymer (cyclic olefin copolymer, COC) has excellent water vapor barrier properties, and hygroscopic particle (MgO and CaO) is able to absorb any moisture which leaks through temporarily, and later release these water molecules under dry conditions. The group is expecting do provide a scalable, new encapsulating material with better properties, in both performance and price.

Key Accomplishments:

The group has used a composite of PS-P2VP copolymer, composed of hydrophobic and hydrophilic parts, and hygroscopic MgO nanoparticle. We performed an optical WVTR test, using Ca layer underneath their encapsulating material as a detection material, as shown in Figure 1. The calcium layer was fairly stable, exposed to 85°C/85% humidity condition over 530 hours.

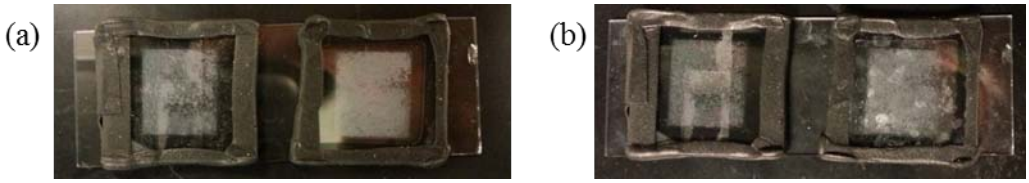

Figure 1. Change of Ca layer under PS-P2VP block copolymer layer, exposed to 85 °C/85% condition (a) for 15 min and (b) for 530 hrs.

In addition to the previous material, we also tried another composite of hydrophobic copolymer and hygroscopic nanoparticle. Figure 2 shows UV-Vis spectrum of a composite layer of cyclic olefin copolymer (COC) and magnesium oxide (MgO, ~50 nm). COC is well-known for its excellent optical property, and it implies that there is no noticeable UV-vis transparency, even

after incorporation of nanoparticle.

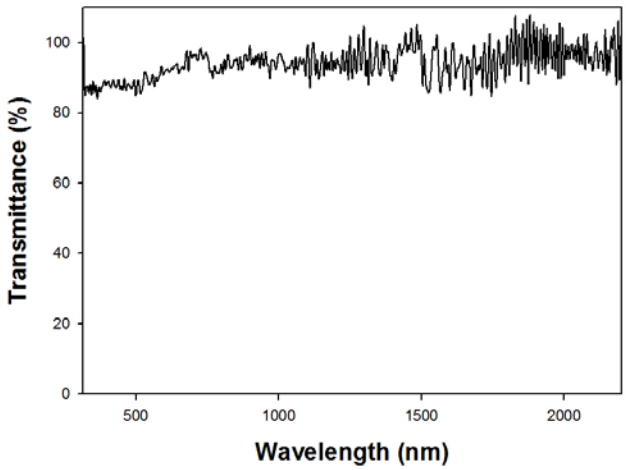

Figure 2. UV-vis spectrum of a composite of COC and MgO.

Future Work:

We will confirm our WVTR data in-house by comparing with data obtained from a certified WVTR testing company, and plan to submit a paper with the results on this first material system (PVP/MgO). Furthermore, we will keep developing the second material system based on the COC which promises better results. We will also focus on enhancing the dispersibility of nanoparticles inside polymer matrix, and test both mechanical and optical properties as well as WVTR with multi-layer system in collaboration with other BAPVC members.