Composite Gas Barrier Film with a Liquid Inner Layer

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Gas barrier film (GBF) is a vital protection component that minimizes the penetration of water vapor into the flexible optical-electronic devices. It usually contains multiple organic and inorganic layers. Vacuum deposition technology was applied to produce multilayered gas barrier films before, but recently many films are made through cost-effective and green wet coating methods. However, currently GBF is still rather expensive because of the multi-layered structures and complicated processes.

A novel approach of fabricating a new type of GBF is proposed here. The new GBF also has a multilayered structure but at least one of the inner layers is a liquid. The selection of the liquid layer is based on the free volume theory and the physio-chemical interactions with water. Solid particles that absorb water vapor can be added to improve the barrier effectiveness. A slot die coater was used to deposit

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the liquid layer, and an UV curable sealant was coated as a narrow stripe around the liquid layer to prevent side leaking. Several solid/liquid GBF were fabricated, and a better sample appeared to be the one made by indium tin oxide (ITO) coated polyethylene terephthalate (PET) films with an inner liquid layer of glycerol containing nano clay particles. The simple three-layered GBF is able to reduce the water vapor transmission rate to lower than 10^{-2} g/m^2-day, which is compatible with most of the results reported in open literature.