Moisture permeability through multilayered barrier films as applied to flexible OLED display

Strict protection of organic light-emitting diodes (OLEDs) and other optoelectronic materials from direct contact with ambient moisture and oxygen is one of the major challenges in the development of flexible OLED displays and other flexible electronic devices. This problem is typically addressed by the use of polymeric substrates with multilavered barrier coatings comprising alternating organic/inorganic layers. The multilayered barrier approach is critically examined using a numerical model based on a defect-dominated diffusion process combined with experiments involving face-to-face lamination of two barrier films. The modeling results identify two regimes, corresponding to two distinct permeation mechanisms, and provide scaling relationships and general design criteria for multilayered barrier coatings. The results suggest that the most significant gain in barrier performance can be realized when the thickness of the organic/adhesive layer(s) in the multilayered structure is less than the average pinhole (defect) size in the inorganic barrier layer(s).