



(51) International Patent Classification:
H01L 51/52 (2006.01) *G02B 5/02* (2006.01)

(21) International Application Number:
PCT/US2009/066238

(22) International Filing Date:
1 December 2009 (01.12.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12/336,889 17 December 2008 (17.12.2008) US

(71) Applicant (for all designated States except US): **3M INNOVATIVE PROPERTIES COMPANY** [US/US]; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

(72) Inventors: **ZHANG, Jun-Ying**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **BARAN, Jimmie R., Jr.**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **SMITH, Terry L.**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **SCHULTZ, William, J.**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **KOLB, William Blake**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **PATNAUDE, Cheryl A.**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **LAMANSKY, Sergey A.**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **NELSON, Brian K.**; 3M Center, Post

Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **JING, Naiyong**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US). **KOLB, Brant U.**; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

(74) Agents: **VIETZKE, Lance L.** et al.; 3M Center, Office of Intellectual Property Counsel Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

[Continued on next page]

(54) Title: LIGHT EXTRACTION FILM WITH NANOPARTICLE COATINGS

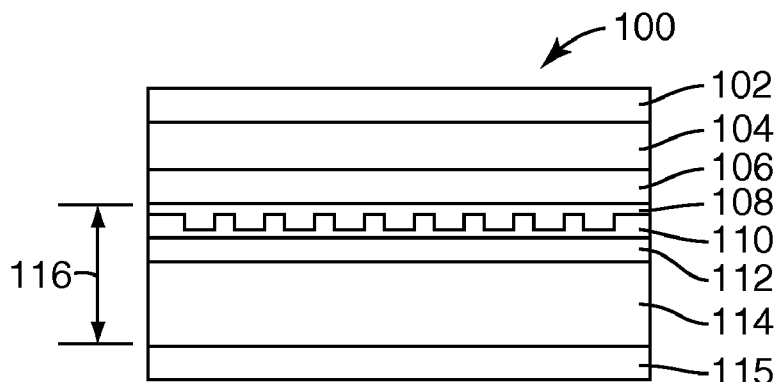


Fig. 1

(57) Abstract: A multifunctional optical film for enhancing light extraction includes a flexible substrate, a structured layer having nanoparticles of different sizes, and a backfill layer. The structured layer effectively uses microreplicated diffractive or scattering nanostructures located near enough to the light generation region to enable extraction of an evanescent wave from an organic light emitting diode (OLED) device. The backfill layer has a material having an index of refraction different from the index of refraction of the structured layer. The backfill layer also provides a planarizing layer over the structured layer in order to conform to the light extraction film to a layer of an OLED display device. The film may have additional layers added to or incorporated within it to an emissive surface in order to effect additional functionalities beyond improvement of light extraction efficiency.



-
- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))* — *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
- (88) Date of publication of the international search report:**
10 September 2010
- Published:**
- *with international search report (Art. 21(3))*