

Exhibit 5

(12) **United States Patent**
Vo et al.

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 (45) **Date of Patent:** **Jun. 13, 2017**

(54) **QUANTUM DOT FILMS UTILIZING MULTI-PHASE RESINS**

(2013.01); *B32B 2307/7242* (2013.01); *B82Y 20/00* (2013.01); *Y10T 156/10* (2015.01)

(71) Applicant: **Nanoco Technologies, Ltd.**, Manchester (GB)

(58) **Field of Classification Search**
 CPC *H01L 33/502*; *C09K 11/703*; *C09K 11/02*
 See application file for complete search history.

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(73) Assignee: **Nanaco Technologies Ltd.**, Manchester (GB)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 312 days.

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(21) Appl. No.: **14/460,008**

(22) Filed: **Aug. 14, 2014**

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(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 61/865,692, filed on Aug. 14, 2013.

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Primary Examiner — Mark Kaucher
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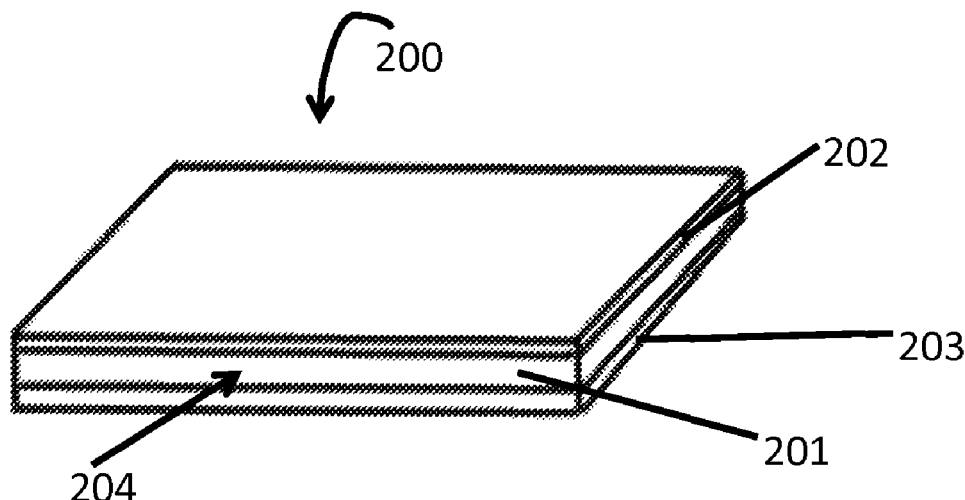
(51) **Int. Cl.**
B82Y 20/00 (2011.01)
H01L 33/50 (2010.01)
B32B 37/24 (2006.01)
C09K 11/70 (2006.01)
C09K 11/02 (2006.01)

(57) **ABSTRACT**

Multi-phase polymer films containing quantum dots (QDs) are described herein. The films have domains of primarily hydrophobic polymer and domains of primarily hydrophilic polymer. QDs, being generally more stable within a hydrophobic matrix, are dispersed primarily within the hydrophobic domains of the films. The hydrophilic domains tend to be effective at excluding oxygen.

(52) **U.S. Cl.**
 CPC *H01L 33/504* (2013.01); *B32B 37/24* (2013.01); *C09K 11/02* (2013.01); *C09K 11/703* (2013.01); *H01L 33/502* (2013.01); *B32B 2037/243* (2013.01); *B32B 2307/418*

1 Claim, 4 Drawing Sheets



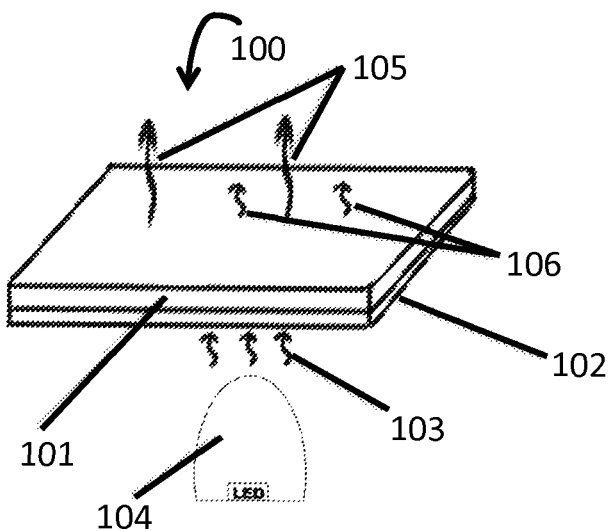


Figure 1 (prior art)

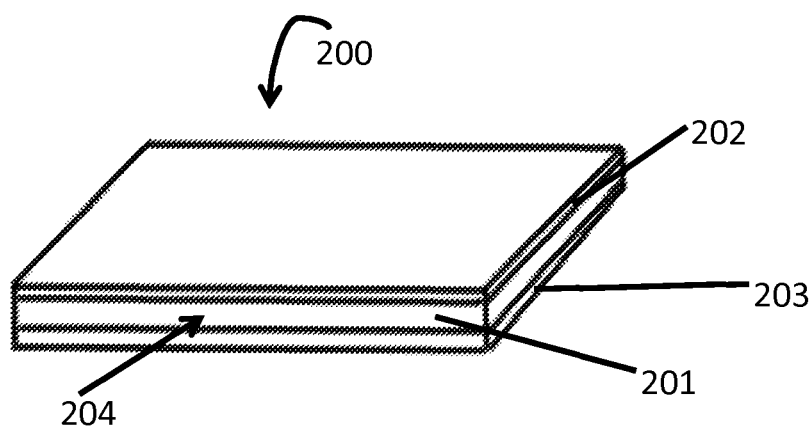


Figure 2

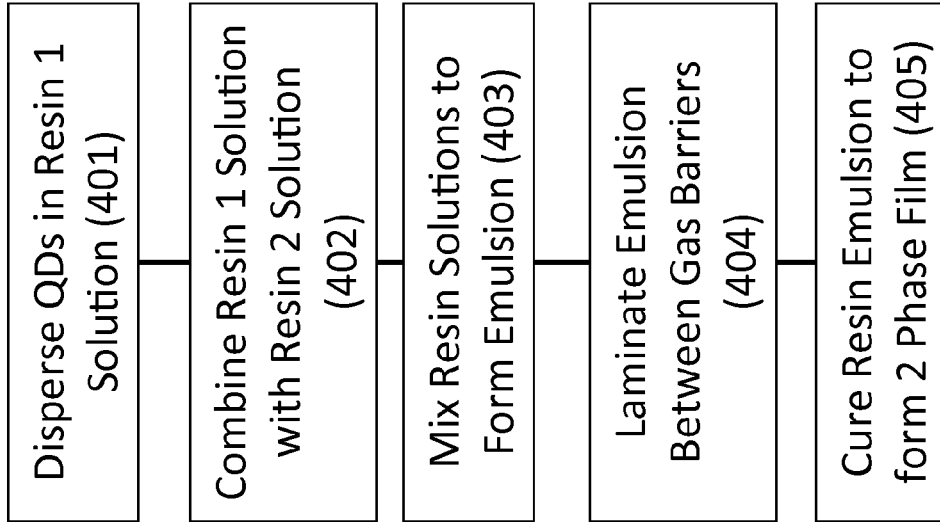


Figure 4

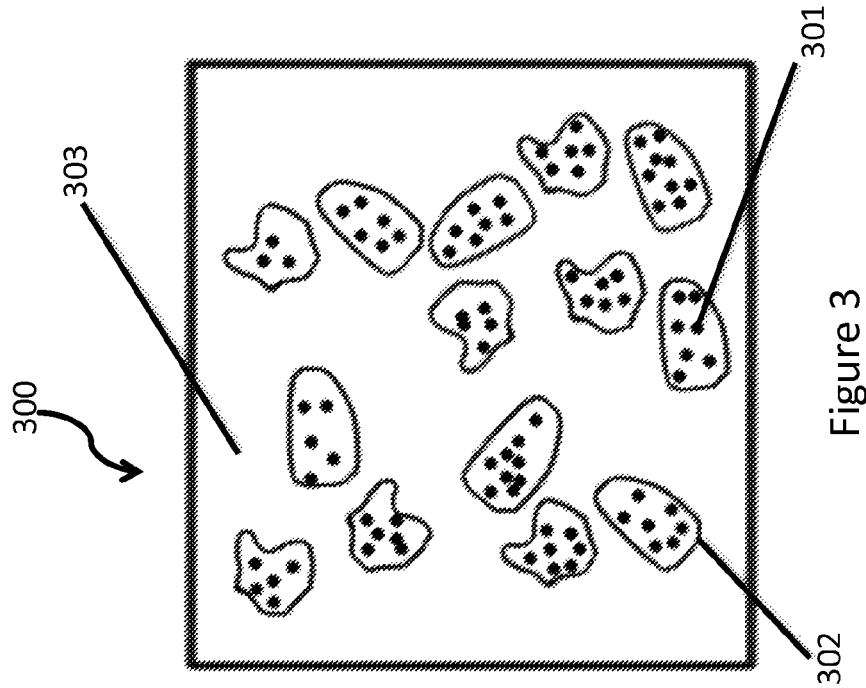


Figure 3

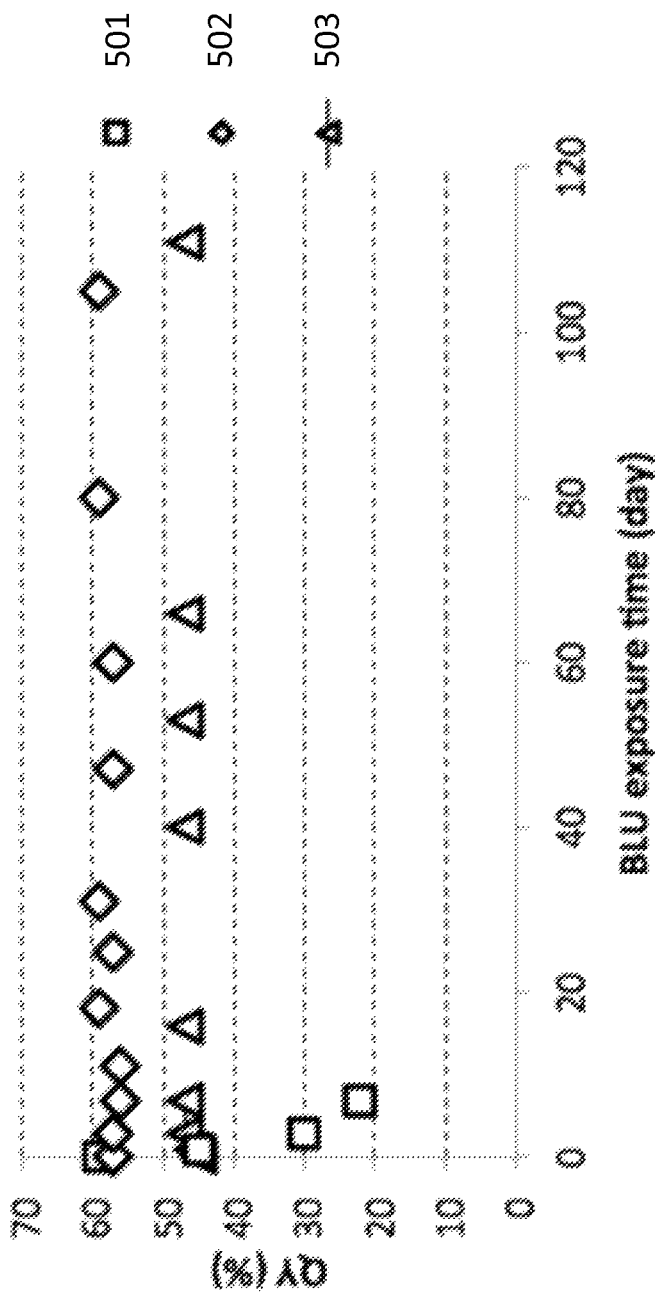


Figure 5

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