



US007312100B2

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

(10) **Patent No.:** **US 7,312,100 B2**
(45) **Date of Patent:** **Dec. 25, 2007**

(54) **IN SITU PATTERNING OF ELECTROLYTE FOR MOLECULAR INFORMATION STORAGE DEVICES**

(75) Inventors: **David F. Bocian**, Riverside, CA (US);
Werner G. Kuhr, Oak Hills, CA (US);
Jonathan S. Lindsey, Raleigh, NC (US);
Veena Misra, Raleigh, NC (US)

(73) Assignee: **The North Carolina State University**,
Raleigh, NC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/837,028**

(22) Filed: **Apr. 30, 2004**

(65) **Prior Publication Data**

US 2005/0207208 A1 Sep. 22, 2005

Related U.S. Application Data

(60) Provisional application No. 60/473,782, filed on May 27, 2003.

(51) **Int. Cl.**
H01L 51/40 (2006.01)

(52) **U.S. Cl.** **438/99**; 257/40; 365/151;
365/153; 977/896; 977/943

(58) **Field of Classification Search** 977/DIG. 1,
977/896, 943; 429/30, 303, 33, 42, 43;
524/200, 790; 530/391.3, 391.5, 391.9;
257/E21.007, 40; 365/151, 153; 205/334;
361/523; 424/1.53; 525/919; 8/408; 438/99
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,687,732 A * 8/1987 Ward et al. 435/6
5,429,708 A * 7/1995 Linford et al. 216/66
5,536,573 A * 7/1996 Rubner et al. 428/378

6,208,553 B1 * 3/2001 Gryko et al. 365/151
6,212,093 B1 4/2001 Lindsey
6,272,038 B1 8/2001 Clausen et al.
6,324,091 B1 11/2001 Gryko et al.
6,365,068 B1 * 4/2002 Michot et al. 252/500
6,381,169 B1 4/2002 Bocian et al.

(Continued)

OTHER PUBLICATIONS

Decher, "Fuzzy Nanoassemblies: Toward Layered Polymeric Multicomposites," *Science*, vol. 277 (Aug. 29, 1997), pp. 1232-1237.*

Primary Examiner—Richard T. Elms

Assistant Examiner—Michael Lulis

(74) *Attorney, Agent, or Firm*—Beyer Weaver LLP; Tom Hunter

(57) **ABSTRACT**

This invention pertains to methods assembly of organic molecules and electrolytes in hybrid electronic. In one embodiment, a method is provided that involves contacting a surface/electrode with a compound of formula: R-L²-M-L¹-Z¹ where Z¹ is a surface attachment group; L¹ and L² are independently linker or covalent bonds; M is an information storage molecule; and R is a protected or unprotected reactive site or group; where the contacting results in attachment of the redox-active moiety to the surface via the surface attachment group; and ii) contacting the surface-attached information storage molecule with an electrolyte having the formula: J-Q where J is a charged moiety (e.g., an electrolyte); and Q is a reactive group that is reactive with the reactive group (R) and attaches J to the information storage molecule thereby patterning the electrolyte on the surface.

30 Claims, 11 Drawing Sheets

