



US006808542B2

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

(10) **Patent No.:** **US 6,808,542 B2**  
(45) **Date of Patent:** **Oct. 26, 2004**

(54) **PHOTOLUMINESCENT MARKERS AND METHODS FOR DETECTION OF SUCH MARKERS**

(75) Inventors: **My T. Nguyen**, Kirkland (CA);  
**Francois Raymond**, Montreal (CA);  
**Steven Xiao**, Laval (CA)

(73) Assignee: **American Dye Source, Inc.**, Quebec (CA)

(\*) 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.: **10/025,830**

(22) Filed: **Dec. 26, 2001**

(65) **Prior Publication Data**

US 2003/0154647 A1 Aug. 21, 2003

(51) **Int. Cl.**<sup>7</sup> ..... **C10L 1/10**

(52) **U.S. Cl.** ..... **44/300**; 585/7; 585/10; 585/11; 585/14; 436/56

(58) **Field of Search** ..... 436/56; 585/7, 585/10, 11, 14; 44/300; 549/32; 548/125, 134, 416, 427; 564/305

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,209,302 A	6/1980	Orelup	
4,735,631 A	4/1988	Orelup	
5,205,840 A	4/1993	Friswell et al.	
5,498,808 A	3/1996	Smith	
5,525,516 A	6/1996	Krutak et al.	
5,807,974 A *	9/1998	Kim et al.	528/366
5,876,864 A *	3/1999	Kim et al.	428/690
5,902,750 A	5/1999	Fuerholzer et al.	

5,980,593 A	11/1999	Friswell et al.	
5,984,983 A	11/1999	Asgaonkar	
6,344,286 B1 *	2/2002	Kim et al.	428/690
6,372,154 B1 *	4/2002	Li	252/301.16
6,399,224 B1 *	6/2002	Li	428/690

\* cited by examiner

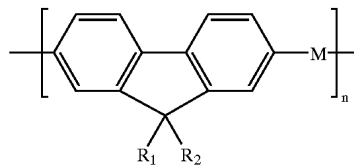
*Primary Examiner*—Cephia D. Toomer

(74) *Attorney, Agent, or Firm*—Merek, Blackmon & Voorhees, LLC

(57) **ABSTRACT**

The invention provides photoluminescent markers consisting essentially of fluorene copolymers, which are colorless or nearly colorless to the naked eye and exhibit strong photoluminescence between about 380–800 nm upon exposure to ultra-violet radiation or laser light. The soluble fluorene copolymers described in this invention having a general formula as shown in Formula 1.

Formula 1



where:

R<sub>1</sub> and R<sub>2</sub> are C<sub>1</sub>–C<sub>24</sub> linear or branched alkyl chain, n is the number of repeating unit,

M is a co-monomer unit having structures chosen to impart distinct physical or chemical properties to the marker. Also provided in the present invention are methods of use of the markers for tagging solid or liquid products and methods to detect said markers.

**15 Claims, 4 Drawing Sheets**

