



US007947502B2

(12) **United States Patent**
Resch-Genger et al.

(10) **Patent No.:** **US 7,947,502 B2**
(45) **Date of Patent:** **May 24, 2011**

(54) **METHOD AND KIT FOR CALIBRATING A
PHOTOLUMINESCENCE MEASUREMENT
SYSTEM**

(75) **Inventors:** **Ute Resch-Genger**, Berlin (DE);
Dietmar Pfeifer, Berlin (DE); **Christian
Monte**, Berlin (DE); **Angelika
Hoffmann**, Berlin (DE); **Pierre
Nording**, Gams SG (CH); **Bernhard
Schönenberger**, Azmoos SG (CH);
Katrin Hoffmann, Berlin (DE); **Monika
Spieles**, Berlin (DE); **Knut Rurack**,
Berlin (DE)

(73) **Assignees:** **Sigma-Aldrich GmbH**, Buchs (CH);
**BAM Bundesanstalt für
Materialforschung und-prüfung**,
Berlin (DE)

(*) **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.:** **12/729,614**

(22) **Filed:** **Mar. 23, 2010**

(65) **Prior Publication Data**

US 2010/0219333 A1 Sep. 2, 2010

Related U.S. Application Data

(62) Division of application No. 11/223,202, filed on Sep.
9, 2005, now Pat. No. 7,713,741.

(30) **Foreign Application Priority Data**

Sep. 10, 2004 (DE) 10 2004 044 717

(51) **Int. Cl.**
G01N 31/00 (2006.01)
G01N 21/76 (2006.01)
G01J 1/58 (2006.01)
G01J 1/10 (2006.01)

(52) **U.S. Cl.** **436/8**; 436/164; 436/171; 436/172;
73/1.01; 702/22; 702/28; 250/252.1; 250/458.1;
422/82.05; 422/82.08; 422/430; 356/243.1

(58) **Field of Classification Search** 436/8, 164,
436/171, 172; 73/1.01; 702/22, 27, 28, 32;
250/252.1, 458.1, 459.1; 422/61, 82.05,
422/82.08, 430; 356/243.1

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,704,891 A 11/1987 Recktenwald et al.
7,713,741 B2 * 5/2010 Resch-Genger et al. 436/8
2006/0233668 A1 10/2006 Resch-Genger et al.

FOREIGN PATENT DOCUMENTS

DE 37 81 85 T2 4/1993
DE 195 15 821 C2 10/1996
DE 198 47 370 A1 4/2000
DE 102 00 865 A1 10/2002
DE 695 30 323 A1 2/2004

OTHER PUBLICATIONS

Pfeifer et al. *Journal of Fluorescence*, vol. 16, 2006, pp. 581-587.*
J.W. Hofstraat, et al.; "Correction of Fluorescence Spectra"; *Applied
Spectroscopy*; vol. 48, No. 4, 1994, p. 436-447.
R.A. Velapoldi, et al.; *Standard Reference Materials: A Fluorescence
Standard Reference Material: Quinine Sulfate Dihydrate*; Jan. 1980;
U.S. Department of Commerce; pp. iii-115.
Resch-Genger et al. *Journal of Fluorescence*, vol. 15, No. 3, May
2005, pp. 315-336.
Resch-Genger et al. *Journal of Fluorescence*, vol. 15, No. 3, May
2005, pp. 337-362.
J.A. Gardecki et al.; *Set of Secondary Emission Standards for Cali-
bration of the Spectral Responsivity in Emission Spectroscopy*;
Applied Spectroscopy, vol. 52, No. 9, 1998, pp. 1179-1189.

* cited by examiner

Primary Examiner — Maureen M Wallenhorst

(74) *Attorney, Agent, or Firm* — Norris McLaughlin &
Marcus, P.A.

(57) **ABSTRACT**

The invention is directed to a method and a kit for calibrating
a photoluminescence measurement system, in particular a
fluorescence measurement system. The kit includes a number
of fluorescence standards i and their corrected and certified
fluorescence spectra $I_i(\lambda)$, whereby the fluorescence stan-
dards i are selected, so that their spectrally corrected fluo-
rescence spectra $I_i(\lambda)$ cover a broad spectral range with high
intensity. The standards are characterized by large half-
widths FWHM _{i} of their bands of at least 1400 cm⁻¹. Accord-
ing to the method of the invention, partial correction functions
 $F_i(\lambda)$ are generated by forming the quotient of the measured
fluorescence spectra $J_i(\lambda)$ and the corresponding corrected
fluorescence spectra $I_i(\lambda)$, which are then combined to form a
total correction function $F(\lambda)$ for a broad spectral range. The
combination factors α_i are hereby computed by statistical
averaging of consecutive partial correction functions $F_i(\lambda)$
over only a predefined, limited overlap region $\lambda_{i/i+1} \pm \Delta\lambda_{OL}$
about the mutual crossover wavelength $\lambda_{i/i+1}$.

9 Claims, 4 Drawing Sheets