US010317539B2

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

(10) **Patent No.: US 10,317,539 B2**
(45) **Date of Patent: Jun. 11, 2019**

(54) **RADIATION MONITOR BASED ON WAVELENGTH-DEPENDENT OPTICAL ABSORPTION IN FUSED SILICA OPTICAL FIBERS**

(71) Applicant: **JEFFERSON SCIENCE ASSOCIATES, LLC**, Newport News, VA (US)

(72) Inventors: **Carl Zorn**, Yorktown, VA (US); **Andrew Weisenberger**, Yorktown, VA (US); **Wenze Xi**, Ellicott City, MD (US)

(73) Assignee: **JEFFERSON SCIENCE ASSOCIATES, LLC**, Newport News, VA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 5 days.

(21) Appl. No.: **15/952,841**

(22) Filed: **Apr. 13, 2018**

(65) **Prior Publication Data**

US 2018/0299564 A1 Oct. 18, 2018

Related U.S. Application Data

(60) Provisional application No. 62/485,487, filed on Apr. 14, 2017.

(51) **Int. Cl.**

G01T 1/06	(2006.01)
G01T 1/02	(2006.01)
G01T 3/08	(2006.01)
G01T 3/00	(2006.01)
G01T 5/08	(2006.01)

(52) **U.S. Cl.**

CPC ***G01T 1/06*** (2013.01); ***G01T 1/02*** (2013.01); ***G01T 3/00*** (2013.01); ***G01T 3/08*** (2013.01); ***G01T 5/08*** (2013.01)

(58) **Field of Classification Search**

CPC G01T 1/06; G01T 3/08; G01T 1/02
USPC 250/390.03
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,385,237	A	5/1983	Drukaroff et al.	
5,030,834	A	7/1991	Lindmayer et al.	
5,091,653	A	2/1992	Creager et al.	
5,606,163	A	2/1997	Huston et al.	
5,717,209	A *	2/1998	Bigman	G01N 21/359 250/339.12
6,087,666	A	7/2000	Huston et al.	
8,207,861	B2	6/2012	Beinhocker	
9,322,927	B2	4/2016	Lee et al.	

(Continued)

Primary Examiner — David P Porta
Assistant Examiner — Gisselle M Gutierrez

(57) **ABSTRACT**

A radiation monitor apparatus and method based on wavelength-dependent optical absorption in fused silica optical fibers. The radiation monitor uses the radiation induced optical changes in fused silica optical fibers as a way to quantify and differentiate the large doses of radiation from high energy photons and neutrons as well as providing a method to extend the sensitivity over a large dynamic range of doses from 103 to beyond 106 rads. The radiation monitor enables dynamic monitoring of highly ionizing radiation environments. The radiation monitor reduces sensitivity saturation at high dose levels, provides increased sensitivity over a large dynamic range of doses, and enables differentiation between high energy photon and neutron contributions or poor signal to noise.

10 Claims, 3 Drawing Sheets