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   Nonvolatile magneto-electric field effect transistors for spintronic memory and logic

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6. P.A. Dowben, Ch. Binek, K. Zhang, L. Wang, W.N. Mei, J.P. Bird, U. Singisetti, X. Hong, K.L. Wang, D. Nikonov
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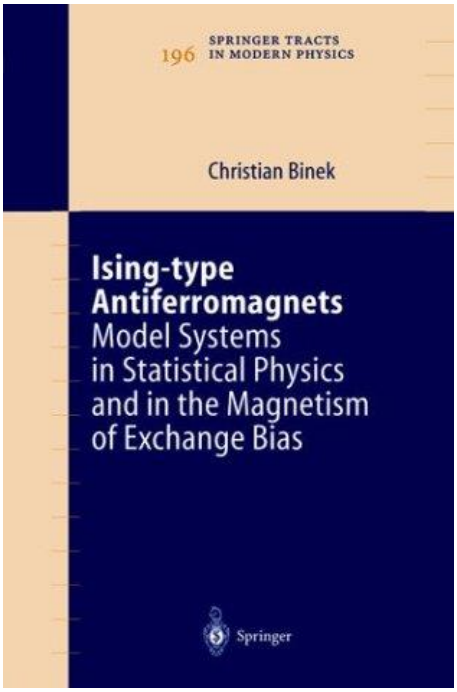

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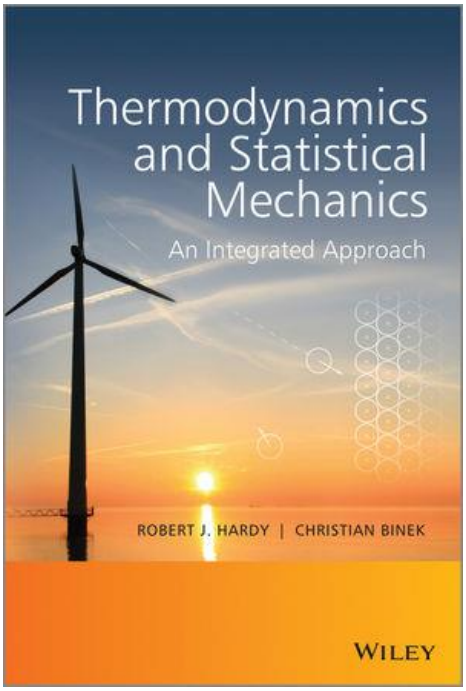
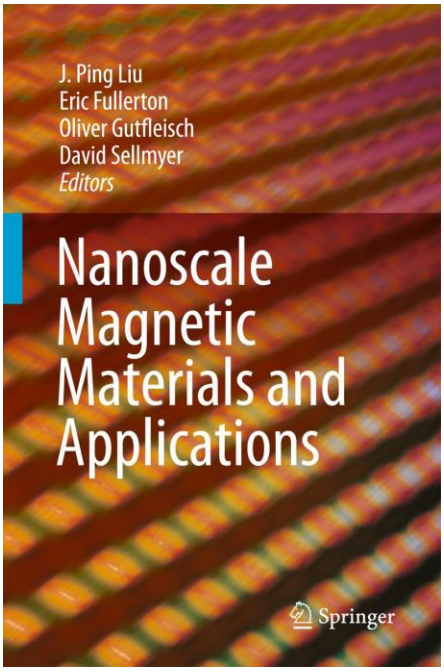
Model systems in statistical physics and the magnetism of exchange bias

Co-authored books

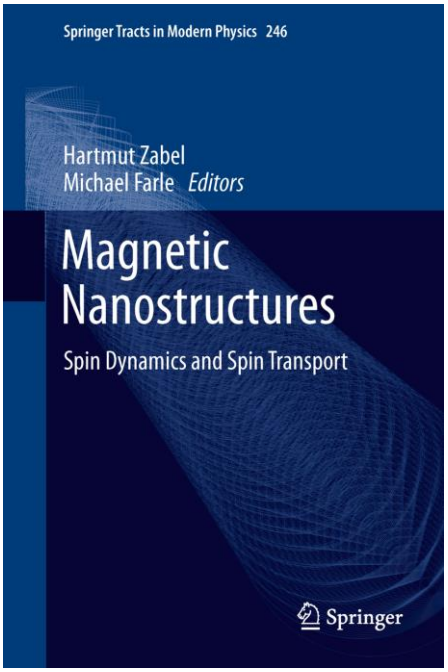


ISBN: 978-1-118-50100-9, 510 pages, May 2014

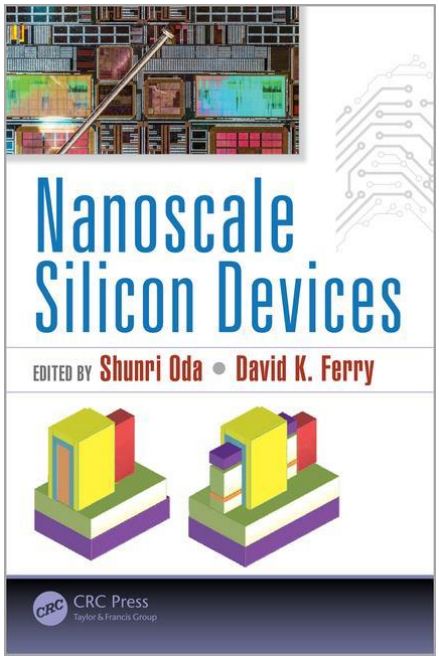
Book chapters



"Tunable Exchange Bias Effects", Chapter **6**, page 159-179.



"Multiferroic and magnetoelectric materials", Chapter 5, page 163-187.



"Potential of Nonvolatile Magnetoelectric Devices for Spintronic Applications"
Chapter **11**, page 255 - 278

Patents

Method for refrigeration through voltage-controlled entropy change, involves generating change in temperature of ferromagnetic materials, in response to generating strain in ferromagnetic materials attached to piezoelectric materials

Patent Number(s): US2014007592-A1
Inventor(s): BINEK C
Patent Assignee Name(s) and Code(s): BINEK C(BINE-Individual)
Derwent Primary Accession Number: 2014-A74862 [06]

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P.O. Box 1450
Alexandria, Virginia 22313-1450
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NOTICE OF ALLOWANCE AND FEE(S) DUE

26191 7590 10/05/2016
FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

EXAMINER
DUKE, EMMANUEL E

ART UNIT	PAPER NUMBER
3744	

DATE MAILED: 10/05/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/161,888	05/23/2016	Christian Binek	24742-0065002	1737

TITLE OF INVENTION: REFRIGERATION THROUGH VOLTAGE-CONTROLLED ENTROPY CHANGE

Magneto-electric spin field effect transistor used for non-volatile memory device, consists of layer of magneto-electric gate dielectric, thin film of channel material, and source and drain disposed in electrical contact with thin film

Patent Number(s): US2014231888-A1
Inventor(s): KELBER J A, BINEK C, BOWDEN P A, BELASHCHENKO K
Patent Assignee Name(s) and Code(s): QUANTUM DEVICES LLC (QUAN-Non-standard)

US009379232B2

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

(10) **Patent No.: US 9,379,232 B2**
(45) **Date of Patent: Jun. 28, 2016**

(54) **MAGNETO-ELECTRIC VOLTAGE CONTROLLED SPIN TRANSISTORS**

(71) Applicants: **University of North Texas**, Denton, TX (US); **Quantum Devices, LLC**, Potomac, MD (US)

(72) Inventors: **Jeffry A. Kelber**, Plano, TX (US); **Christian Binek**, Lincoln, NE (US); **Peter Arnold Bowden**, Crete, NE (US); **Kirill Belashchenko**, Lincoln, NE (US)

(73) Assignee: **QUANTUM DEVICES, LLC**, Rockville, MD (US)

(52) **U.S. Cl.**
CPC ***H01L 29/78*** (2013.01); ***G11C 11/161*** (2013.01); ***G11C 11/5607*** (2013.01); ***H01F 10/002*** (2013.01); ***H01L 29/517*** (2013.01); ***H01L 29/66984*** (2013.01); *B82Y 10/00* (2013.01); *H01F 10/3268* (2013.01); *H01L 29/1606* (2013.01)

(58) **Field of Classification Search**
USPC 257/4, 24, 194, 213, 295
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

Magnetic Spin Valve With a Magnetoelectric Element

Patent Inventorship Correction US patent 7,358,846

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Patent No. 7358846
Issued Date: 15 April, 2008
Appl. No: 11/444,675
Filed.: 01 June 2006

PART (A) RESPONSE FOR CERTIFICATES OF CORRECTION

This is a decision on the Certificate of Correction request filed 04 August 2015.

The request for issuance of Certificate of Correction for the above-identified correction(s) under the provisions of 37 CFR 1.322 and/or 1.323 is hereby:

(Check one)
☒ Approved ☐ Approved in Part ☐ Denied

Comments:

PART (B) PETITION UNDER 37 CFR 1.324 OR 37 CFR 1.48

This is a decision on the petition filed 15 June 2009 to correct inventorship under 37 CFR 1.324.

This is a decision on the request under 37 CFR 1.48, petition filed . In view of the fact that the patent has already issued, the request under 37 CFR 1.48 has been treated as a petition to correct inventorship under 37 CFR 1.324.

The petition is hereby: ☒ Granted ☐ Dismissed

The patented filed is being forwarded to Certificate of Corrections Branch for issuance of a certificate naming only the actual inventor or inventors.

/Amy Cohen Johnson/
Supervisory Patent Examiner, Art Unit 2833
Technology Center 2800
Phone: (571) 272-1850

Certificates of Correction Branch email: CustomerServiceCoC@uspto.gov CoC Central Phone Number: (703) 756-1814

Provisional Application

Tittle of Invention:
Increasing the critical temperature of the magneto-electric Cr_2O_3
Attorney Docket Number 2174-1825
Inventor(s): BINEK C, BOWDEN P A, BELASHCHENKO K, STREET MIKE

Tittle of Invention:
Anti-Ferromagnetic Magneto-electric Spin-orbit Read Logic
Inventor(s):
Dr. Dmitri Nikonov, Intel
Prof. Christian Binek, University of Nebraska at Lincoln
Prof. Xia Hong, University of Nebraska at Lincoln
Prof. Jonathan P. Bird, University at Buffalo
Prof. Kang Wang, University of California – Los Angeles
Prof. Peter A. Dowben, University of Nebraska at Lincoln