Siu-Wai Chan

As of April 2025

Professor of Materials Science and Engineering
Dept. of Applied Physics and Applied Mathematics
Joint appt. with Dept. of Earth & Environmental Engr.
School of Engineering and Applied Science,
Columbia University, New York, NY 10027
212-854-4458(dept#), 212-854-8257(fax), 201-681-5548(cell, txt 1st)
email: sc174@columbia.edu

RESEARCH INTERESTS

Grain Boundaries, Interfaces, and Defects in Films and Oxides for Device, Energy and Environment, Crystal-size-dependent Properties of Nano-crystals.

EDUCATION

Massachusetts Institute of Technology, Sc.D. in Materials Science and Engineering;
Columbia University, B.S. in Metallurgy & Materials Sc. Francis B.F. Rhodes Prize

PROFESSIONAL EXPERIENCE

Full Professor since 2002,
Prof. of Henry Krumb School of Mines since 1990,
Co-Chair of the Solid State Program 2001-2010,
Co-chair of Materials Science and Engineering Program and Committee till 1999.
Executive Committee Member and Outreach Director of Materials Research Science & Engineering Center NSF-MRESC ten years,
Associate Professor Columbia University, till 2002,
1990-1993 Metallurgy and Mining, 1993-1998 Chemical Engineering and Materials, 1998-present Applied Physics and Applied Mathematics.

Visiting Professor, as the *Tan Fellow* at Nanyang Technological Univ., Materials Dept., Singapore 2004 ;
Visiting Professor, as NSF 2004 *Advanced Fellow*, Univ. of Washington, Dept. of Materials Sc. and Engr., Seattle, WA;

2004 Visiting Professor, as the *Guggenheim Fellow* Univ. of California San Diego, Physics Dept. of Physics, San Diego, California (host Prof. Robert Dynes, Chancellor of UCSD & President of Univ. of California till 2008);
Visiting Scientist, (full-salary support from IBM Microelectronics) IBM Watson Research Lab., 1999.
Visiting Scientist, Bitter Magnet Lab, 1995.

Member of Technical Staff, High Temperature Superconductors, and …Surface Treatments, Bell-Labs, NJ, 1985-1990.

PROFESSIONAL ACTIVITIES

Member of the Minerals, Metals, Materials Society (TMS)
Member of the Materials Research Society (MRS)
Committee editorial member of a special JOM issue on Computational Materials Science (2021)
Member of the American Ceramic Society (ACerS)
Strategic Planning Committee ACerS 2009-2010,
Chair of the Electronics Division of ACerS 2006-2007,
Chair Symposia at different MS&T Meetings,
Chair Symposia on High Temperature Superconductors at 1998 & 91 Materials Research Society (MRS) Fall Meetings;
Chair for various sessions at different MRS, TMS and ACerS Meetings,
President 1994 & Secretary 1993 of the Materials Science Club;
Panelist for National Science Foundation's program on Materials Research Science and Engineering Centers,
Reviewer on Materials Science Projects for NSF,
Reviewer on Materials Science Projects for Hong Kong University Research Council;
Reviewer for Philosophical Magazine, Applied Physics Letters, Journal of Applied Physics and Journal of Materials Research.
Faculty Advisor of student Chapters of ACerS 1998-2011 & TMS 2007-2011, MRS since 1994, Materials Advantage (ASM, ACers, TMS, & AIST) since 2012.

ASSOCIATIONS

American Physical Society (APS);
Society of Women Engineers (SWE);
International Committee of Diffraction Data (ICDD);
Materials Research Society (MRS) Faculty Advisor of the CU Student Chapter over 25 years;
ASM International (ASM);
Association for Iron & Steel Technology (AIST);
The Minerals, Metals, Materials Society (TMS);
The American Ceramic Society (ACerS)
Faculty Advisor of the CU-Student Chapter of Materials Advantage since 2012 (student-society for ASM, AIST, TMS, & ACerS).
American Chemical Society (ACS)

HONORS & AWARDS

Presidential Faculty Fellow (PFF), from President William Jefferson Clinton and National Science Foundation (NSF). Only 30 most promising professors in science and engineering were honored each year. Later PFF evolved into Presidential Early Career Award for Scientists and Engineers. (PECASE) with 100+ awards per year.

Tan Chin Tuan Fellowship (Singapore Nanyang Technological University),
Advance Fellow of Univ. of Washington and National Science Foundation (NSF),
John Simon Guggenheim Fellow,
IBM Faculty Award,
Fellow of American Physical Society
BASF Catalysis Faculty Award,
Fellow of the American Ceramics Society,
Avenessians Diversity Award from Columbia University
Very **I**mportant **P**arent from Luther Lee Emerson School in Demarest, NJ
Outstanding Woman Scientist Award, Women in Science, NYC,
DuPont Faculty Award,
Tau Beta Pi elected;
Sigma Xi elected;
Columbia Univ. Engr. School, Francis B.F. Rhodes Prize.

PUBLICATIONS 111 publications with 84 papers in referred journals.
See Scopus ID, ORCID and google scholar websites below

PRESENTATIONS Delivered over 140 invited talks.

PATENTS

U. S. patent # 9,199,858 granted in Dec 2015, 'Methods for producing nanoparticles using palladium salt and uses thereof' with Hong Liang.

U.S. #7,820,596B2 awarded Oct 26, 2010, 'Thick Film High Temperature Superconducting Device Supporting High Critical Currents and Method for Fabricating Same.'

U.S. # 7,449,163 awarded Nov 11, 2008, 'Method for Preparing Nanoparticles comprising Cerium Oxide and Zirconium' With Feng Zhang.

U.S. # 7,320,732 awarded Jan. 22, 2008, 'Method for Preparing Atomistically Straight Boundary Junctions in High Temperature Superconducting Oxides.'

PATENTS

U.S. # 7,141,227 awarded Nov 28, 2006, 'Apparatus and Method for Preparing Cerium Oxide Nanoparticles.'

U.S. # 5,087,608 awarded Feb. 11, 1992, 'Environmental Protection and Patterning of Superconducting Perovskites' with L.A. Farrow.

https://patents.justia.com/inventor/siu-wai-chan

POST-Docs & STUDENTS advised in Research

Research faculty advisor for 6 post-docs, 80 graduate students including 60+ terminal master's degree students and 65+ undergraduate students with their capstone senior research projects and summer research internships. Besides doctoral students, most master's degree and undergraduate students have been actively involved in group research activities. Some of them have their first papers written with SWC. Some students/postdocs have become professors, e.g. Professors Oratai **Jongprateep** of Kasetsart Univ. , Qiuming **Wei** at Univ. of North Carolina, Papot **Jaroenapibal** of Khon Kaen University in Thailand, **Wang** Bin of Beijing Chemical Engineering University and Suraj **Cheema** of MIT. Others become leaders in their own field, e.g. Drs. Robin **Tichy** of HP, Sung Joo **Kim** of Brookhaven Nat'l Lab and P.P. **Rodenbough** at NYU-UAE. Most of them have had their first research and leadership experience within the Chan's group. As a few of them were presidents of the TMS MA, MRS, ACerS student chapters at Columbia with SWC as the faculty advisor. Most former students and post-docs have become senior research scientists and directors of Fortune 500 companies, e.g. Drs Feng Zhang at Headway and Manoj Chopra at Western Digital, Jenna Pike at 3L, Larry Zhao at Applied Materials, Chunyan Tian at Apple, Philips P. Rodenbough at NYU-UAE, Yang Du at Qualcomm (CTO till 2024), and John Qin at Micron Technology.

WEBSITES

https://apam.columbia.edu/siu-wai-chan
https://engineering.columbia.edu/faculty/siu-wai-chan

https://patents.justia.com/inventor/siu-wai-chan

https://scholar.google.com/citations?user=n0MJCx0AAAAJ&hl=en

https://orcid.org/0000-0003-0482-9783
Scopus Author ID: 7404255242

Size-dependent Properties of CeO_{2-y} Nanoparticles as studied by Raman Scattering, Jonathan E. Spanier, Richard D. Robinson, Feng Zhang, Siu-Wai Chan and Irving Herman, Phys. Rev. B. 64 245407 (2001) 1138 citations

Cerium and Yttrium Oxide Nanoparticles Are Neuroprotective, David R. Schubert, Richard Dargusch, Joan Raitano, and Siu-Wai Chan, Biochemical and Biophysical Research Communications, 342 pp 86-91 (2006) 915 citations

Cerium oxide nanoparticles: size-selective formation and structure analysis, Feng Zhang, Siu-Wai Chan, Jonathan E. Spanier, Ebru Apak, Qiang Jin, Richard D. Robinson, and Irving Herman, Appl. Phys. Lett., 80, pp.127-129 (2002) 918 citations

Cerium oxidation state in ceria nanoparticles using x-ray photoelectron spectroscopy and X-ray absorption near edge spectroscopy, Feng Zhang, Peng Wang, J. Koberstein, S. Khalid, and Siu-Wai Chan, Surface Science, 563, pp. 74-82 (2004) 691 citations

Ceria Nanoparticles: Size, Size Distribution and Shape, Feng Zhang, Qing Jin and Siu-Wai Chan, J. of Applied Physics, 95, pp. 4319-4326 (2004) 434 citations

Ionic Conductivities, Sintering Temperatures and Microstructures of Bulk Ceramic CeO_2 Doped with Y_2O_3, C. Tian, and Siu-Wai Chan, Solid State Ionic, 134, pp.89-102 (2000) 276 Citations

Structure Sensitivity of the Low-temperature Water-Gas Shift Reaction on Cu-CeO2 Catalysts, Rui Si, Joan Raitano, Lihua Zhang, Siu-Wai Chan, Maria Flytzani-Stephanopoulos, Catalysis Today, 180, pp 68-80 (2012) 234 Citations

Phases in Ceria-Zirconia Binary Oxide $(1-x)CeO_2$-$xZrO_2$ Nanoparticles: The Particle-Size Effect, Feng Zhang, Chih-Hao Chen, Jonathan C. Hanson, Richard D. Robinson, Irving P. Herman, and Siu-Wai Chan, J. of Amer. Ceramics Soc., 89, pp 1028-1036, (2006) 209 Citations

Formation of Stable Cu_2O from reduction of CuO nanoparticles, Jenna Pike, Siu-Wai Chan, Feng Zhang, X. Wang, Jonathan C. Hanson, Applied Catalysis A: General 303 pp. 273-277 (2006) 202 Citations

Application of a Near Coincidence Site Lattice Theory to the Orientations of $YBa_2Cu_3O_{7-x}$ Grains on (001) MgO Substrates, D.M. Hwang, T.S. Ravi, R. Ramesh, Siu-Wai Chan, C.Y. Chen, L. Nazar, X.D. Wu, A. Inam, and T. Venkatesan, Appl. Phys. Lett., 57 1690 (1990) 171 Citations

Madelung-Model Prediction for the Lattice Constant Scaling with the Size of Ionic Nanocrystals of CeO2 and BaTiO3, Vasili Perebeinos, Siu-Wai Chan and Feng Zhang, Solid State Communications, 123, Issues 6-7, pp. 295-297 (2002) 157 Citations

Martensitic Phase Transformation of Isolated HfO_2, ZrO_2 and $Hf_xZr_{1-x}O_2$ ($0<x<1$) Nanocrystals, Jing Tang, Feng Zhang, Peter Zoogman, Jason Fabbri, Siu-Wai Chan, Yimei Zhu, Louis E. Brus, and Michael L. Steigerwald, Advanced Materials 15 pp.1595-1602 (2005) 132 Citations

Epitaxy of Y-Ba-Cu-O thin films grown on single crystal of MgO, APL 56 p2243(1990) 119 Citations

Study of Energy versus Misorientation for Grain Boundaries in Gold by Crystallite Rotation Method--I. [001] Twist Boundaries, Siu-Wai Chan, and R.W. Balluffi, Acta Metallurgica, 33 1113 (1985) 107 Citations

Scanning Tunneling Microscopy and Theoretical Study of Water Adsorption on Fe_3O_4: Implications for Catalysis
KT Rim, D Eom, SW Chan, M Flytzani-Stephanopoulos, GW Flynn, ...
Journal of the American Chemical Society 134 (46), 18979-18985 (2012) 100 Citations

Charging and chemical reactivity of gold nanoparticles and adatoms on the (111) surface of single-crystal magnetite: A scanning tunneling microscopy/spectroscopy study
KT Rim, D Eom, L Liu, E Stolyarova, JM Raitano, SW Chan, ...
The Journal of Physical Chemistry C 113 (23), 10198-10205 (2012) 98 Citations

Charging and chemical reactivity of gold nanoparticles and adatoms on the (111) surface of single-crystal m
scanning tunneling microscopy/spectroscopy study
KT Rim, D Eom, L Liu, E Stolyarova, JM Raitano, SW Chan, ...
The Journal of Physical Chemistry C 113 (23), 10198-10205 (2009) 92 Citations

3D-printing crystallographic unit cells for learning materials science and engineering
PP Rodenbough, WB Vanti, SW Chan
Journal of Chemical Education 92 (11), 1960-1962 (2015) 86 Citations

Synthesis and Redox Behavior of Nanocrystalline Hausmannite (Mn_3O_4)
J Pike, J Hanson, L Zhang, SW Chan
Chemistry of Materials 19 (23), 5609-5616 (2007) 85 Citations

In situ study of the crystallization from amorphous to cubic zirconium oxide: Rietveld and reverse Monte Carlo analyses
F Zhang, PJ Chupas, SLA Lui, JC Hanson, WA Caliebe, PL Lee, ...SW Chan
Chemistry of materials 19 (13), 3118-3126 (2007) 85 Citations

Effect of the post-deposition processing ambient on the preparation of superconducting $YBa_2Cu_3O_{7-x}$ coeva
films using a BaF_2 source

SW Chan, BG Bagley, LH Greene, M Giroud, WL Feldmann, KR Jenkin, ...
Applied physics letters 53 (15), 1443-1445 (1988) 79 Citations

Most Impactful Paper *on Technology*
The stability of Si1− xGex strained layers on small-area trench-isolated silicon
K Schonenberg, SW Chan, D Harame, M Gilbert, C Stanis, L Gignac
Journal of materials research 12 (2), 364-370 (1997) Only 24 Citations

This collaboration between Prof. Chan and IBMers' was facilitated of having Kathy Schonenberg and Carol Stanis as graduate students at Columbia while they were working at IBM Watson.
Prof. Chan helped to solve the mystery of dislocation free SiGe strained layers on Si, which has enabled micron-size CMOS transistors improved from 200MHz in 1990's to today's Giga Hz Bipolar CMOS (BICOM) transistors in nanometer. The epitaxial growth of SiGe on Si had been suffering from misfit dislocations in the transistors' channels.

The speed of adaptation and commercialization has been so fast, hence few citations. Everyone has been busy growing the epi-SiGe on Si wafers and making BICOM's transistors.