

MICHAEL A. SCARPULLA

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A. Professional Preparation

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|------------------|---------------------------------|----------------|-----------------------|
| Brown University | Materials Science & Engineering | Sc.B. (Honors) | May 2000 |
| UC Berkeley | Materials Science & Engineering | M.S. / Ph.D. | Dec. 2003 / May 2006 |
| UC Santa Barbara | Materials Department | Postdoctoral | Nov. 2006 - Jun. 2008 |

B. Appointments

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| 2014 – | Associate Professor, MSE & ECE Departments, University of Utah |
| 2015 – | Adjunct, Department of Physics, U Utah |
| 2010 – | Adjunct, Department of Chemical Engineering, U Utah |
| 2008 – 2014 | Assistant Professor, U Utah MSE & ECE Departments |
| 2006 – 2008 | Postdoctoral Scholar – Rare-earth-V nanoparticles in III-V semiconductors by MBE |
| 2001 – 2006 | PhD Student – Novel compound semiconductor alloys using laser processing |
| 2000 – 2001 | Supplemental Researcher, IBM Almaden Research Center, San Jose, CA |

C. Profile and Relevance to MURI

Prof. Scarpulla's research activities are in compound semiconductor materials combining processing, growth, materials and defect characterization augmented by calculations to develop integrated understanding of their physical behaviors. His group has experience in electrical defect characterization methods such as DLTS, CV, IV, and admittance spectroscopy, device physics and simulation, liquid phase crystal growth, physical vapor deposition and epitaxy, optoelectronic and structural characterization methods, and prediction and manipulation of point defect concentrations. These activities, as well as recent progress in low-temperature synthesis of Ga₂O₃ powder from ultrapure Ga and chemical vapor deposition of Ga₂O₃ are relevant to this MURI proposal.

D. Selected Publications

K. Alberi and M.A. Scarpulla, Suppression of native defect formation during semiconductor processing via excess carrier generation, *Scientific Reports* **6**, 27954 (2016). DOI: [dx.doi.org/10.1038/srep27954](https://doi.org/10.1038/srep27954)

K Alberi and MA Scarpulla, Photoassisted physical vapor epitaxial growth of semiconductors: a review of light-induced modifications to growth processes. *Journal of Physics D: Applied Physics* (online)

K Alberi and MA Scarpulla, Effects of excess carriers on native defects in wide bandgap semiconductors: illumination as a method to enhance p-type doping, (in review, 2017). Available at: <https://arxiv.org/ftp/arxiv/papers/1703/1703.03763.pdf>

V. Kheraj, E.A. Lund, A.E. Caruso, K. Al-Ajmi, D. Pruzan, C. Miskin, R. Agrawal, C. Beall, I. Repins, and M.A. Scarpulla, Minority Carrier Electron Traps in CZTS_{Se} Solar Cells Characterized by DLTS and DLOS. *Proceedings of 43rd IEEE Photovoltaic Specialists Conference*, Portland, OR (Jun. 2016).

Akira Nagaoka, Darius Kuciauskas, and Michael A. Scarpulla, Defect properties of shallow acceptor and metastable AX center in Arsenic doped Cd-rich CdTe single crystals. *Applied Physics Letters*, (accepted 2017)

Junyi Zhu, Feng Liu, and Michael A. Scarpulla, Strain tuning of native defect populations: The case of $\text{Cu}_2\text{ZnSn}(\text{S,Se})_4$ *APL Materials* **2** 012110 (2014). <http://dx.doi.org/10.1063/1.4863076>

V. Kosyak, A.V. Postnikov, J. Scragg, M.A. Scarpulla, and C. Platzer-Björkman, Point defect concentrations in $\text{Cu}_2\text{ZnSnS}_4$: insights into high-temperature equilibrium and quenching, *Journal of Applied Physics*, **122**(3) 035707 (2017)

V. Kosyak, N.B. Mortazavi Amiri, A.V. Postnikov, and M.A. Scarpulla, A Quasichemical Model of Native Point Defect Equilibrium in $\text{Cu}_2\text{ZnSnS}_4$ (CZTS) and Application to One-Zone Annealing. *Journal of Applied Physics*, **114** 124501 (2013). <http://dx.doi.org/10.1063/1.4819206>

D.S. Pruzan, Y. Liu, A.E. Caruso, Y. Lin, C. Beall, I. Repins, M.F. Toney, M.A. Scarpulla, Grain to Grain Composition fluctuations in $\text{Cu}_2\text{ZnSnSe}_4$ thin film solar cells measured by transmission x-ray tomography. *Solar RRL*, 1(1) 1600024 (2017). DOI: <http://dx.doi.org/10.1002/solr.201600024/>. ([Front cover article of inaugural issue](#)).

Mehmet Eray Erkan, Vardaan Chawla, and Michael A. Scarpulla, Reduced defect density at CZTSSe/CdS interface by atomic layer deposition of Al_2O_3 *J. Applied Physics* **119**, 194504 (2016). DOI: <http://dx.doi.org/10.1063/1.4948947>

Jeffery A. Aguiar, Mehmet E. Erkan, Dennis Pruzan, Akira Nagaoka, Kenji Yoshino, Helio Moutinho, Mowafak Al-Jassim, and Michael A. Scarpulla, Cation ratio fluctuations in $\text{Cu}_2\text{ZnSnS}_4$ at the 20 nm length scale investigated by analytical electron microscopy. *Physica Status Solidi A* 213: 2392–2399 (2016) DOI: <http://dx.doi.org/10.1002/pssa.201600060>

D. Synergistic Activities

- (1) Editor, *Journal of Semiconductors* (2016-)
- (2) Editor, *IEEE Journal of Photovoltaics* (2013-)
- (3) Program Committee, Area 2 Chair, *IEEE PVSC* (2011-)
- (4) Program Committee, TMS EMC conference (2015-)
- (5) Program Committees, SPIE OPTO (2011-2014)
- (6) Reviewing NSF EPM, DOE BES, DoE EERE (2010-)
- (7) Reviewer for multiple journals (2006-)
- (8) NREL Hands-On PV Experience for grad students & teaching photovoltaics workshop (2012-)
- (9) Undergraduate course on materials characterization MSE 3011 (2014 -)
- (10) Upper-level course on semiconductors and device physics (2013 -)