

Rishi E. Kumar

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BIOGRAPHICAL SKETCH

I believe that human-AI partnership and automation are epochal pillars for the science of tomorrow, and seek opportunities at the interface of robotics, machine learning, and materials informatics to accelerate material discovery. I strive to use software and hardware automation to expedite research tasks with high precision. Recently, I have designed and implemented an automated platform for high-throughput, closed-loop investigation of optoelectronic thin films. I am currently working on an automated platform for solid state synthesis.

Education & Training

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| University of California, San Diego | Materials Science & Engineering | Ph.D., 2017–2022 |
| University of California, San Diego | Nanoengineering | B.S., 2010–2014 |

Research & Professional Experience

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| 2022 – present | Postdoctoral Researcher, Hacking Materials Group |
| 2017 – 2022 | Ph.D., Fenning Lab |
| 2015 – 2017 | Research Associate II, nanoComposix |
| 2014 – 2015 | R&D Engineer, Kyocera North America |
| 2013 – 2013 | Fabrication Intern, Ultrasolar Technology |
| 2013 – 2013 | Undergraduate Researcher, Maple Lab (UCSD) |

Publications

Peer Reviewed

11. **Rishi E. Kumar**, Armi Tiihonen, Shijing Sun, David P. Fenning, Zhe Liu, and Tonio Buonassisi. Opportunities for machine learning to accelerate halide-perovskite commercialization and scale-up. *Matter*, 5(5):1353–1366, 2022.
10. Sarthak Jariwala, **Rishi E. Kumar**, Giles E. Eperon, Yangwei Shi, David P. Fenning, and David S. Ginger. Dimethylammonium addition to halide perovskite precursor increases vertical and lateral heterogeneity. *ACS Energy Letters*, 0(0):204–210, 2022.
9. **Rishi E. Kumar**, Guillaume Von Gastrow, Nicholas Theut, April M. Jeffries, Tala Sidawi, Angel Ha, Flavia DePlachett, Hugo Moctezuma-Andraca, Seth Donaldson, Mariana I. Bertoni, and David P. Fenning. Glass vs. backsheets: Deconvoluting the role of moisture in power loss in silicon photovoltaics with correlated imaging during accelerated testing. *IEEE Journal of Photovoltaics*, page 1–8, 2021.
8. Arun Mannodi-Kanakkithodi, **Rishi E. Kumar**, DP Fenning, and MKY Chan. First principles modeling of polymer encapsulant degradation in Si photovoltaic modules. *Phys Chem Chem Phys*, 2021.

7. **Rishi E. Kumar**, Xueying L. Quinn, and David P. Fenning. Accounting for sample morphology in correlative x-ray microscopy via ray tracing. *MRS Advances*, 2021.
6. Taewoo Kim, **Rishi E. Kumar**, Jeffrey A. Brock, Eric E. Fullerton, and David P. Fenning. How strain alters CO₂ electroreduction on model Cu (001) surfaces. *ACS Catalysis*, page 6662–6671, 2021.
5. **Rishi E. Kumar**[†], Xueying L. Quinn[†], Moses Kodur, Deniz N Cakan, Zhonghou Cai, Tao Zhou, Martin V Holt, and David P Fenning. Europium addition reduces local structural disorder and enhances photoluminescent yield in perovskite CsPbBr₃. *Adv. Optical Mater.*, page 2002221, 2021.
4. Susan A. Rigter, Xueying L. Quinn, **Rishi E. Kumar**, David P. Fenning, Philippe Massonet, Shane R. Ellis, Ron M. A. Heeren, Katrine L. Svane, Aron Walsh, and Erik C. Garnett. Passivation properties and formation mechanism of amorphous halide perovskite thin films. *Advanced Functional Materials*, page 2010330, 2021.
3. Nengxu Li, Yanqi Luo, Zehua Chen, Xiuxiu Niu, Xiao Zhang, Jiuzhou Lu, **Rishi E. Kumar**, Junke Jiang, Huifen Liu, Xiao Guo, Barry Lai, Geert Brocks, Qi Chen, Shuxia Tao, David P. Fenning, and Huanping Zhou. Microscopic degradation in formamidinium-cesium lead iodide perovskite solar cells under operational stressors. *Joule*, 4(8):1743–1758, 2020.
2. Moses Kodur, **Rishi E. Kumar**, Yanqi Luo, Deniz N. Cakan, Xueying Li, Michael Stuckelberger, and David P. Fenning. X-ray microscopy of halide perovskites: Techniques, applications, and prospects. *Advanced Energy Materials*, 10(26):1–25, 2020.
1. **Rishi E. Kumar**, Guillaume Von Gastrow, Joswin Leslie, Rico Meier, Mariana I. Bertoni, and David P. Fenning. Quantitative determination of moisture content in solar modules by short-wave infrared reflectometry. *IEEE Journal of Photovoltaics*, 9(6):1748–1753, 2019.

In Progress

4. **Rishi E. Kumar**, Moses Kodur, and David P. Fenning. Robotic high-throughput screening of photostable halide perovskites for tandem photovoltaics. *in preparation*.
3. **Rishi E. Kumar** and David P. Fenning. Roboflo: A job scheduler for automated experimentation platforms. *in preparation*.
2. **Rishi E. Kumar**, Moses Kodur, Arun Mannodi-Kannakithodi, and David P. Fenning. The periodic table: An effective manifold for optimizing the composition of halide perovskites using active learning. *in preparation*.
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Conference Talks

5. Multi-objective optimization: A solution for pitfalls in closed-loop robotic experimentation. *Spring MRS*, 2022.

4. Active learning on computed property manifolds in high-throughput experiments. *Fall MRS*, 2021.
3. Deconvoluting the role of moisture in power loss in silicon photovoltaics with correlated imaging during accelerated testing. *IEEE PVSC*, 2021.
2. Morphology-informed correlation across multimodal microscopy data. *Spring MRS*, 2021.
1. Quantitative determination of moisture content in modules by short-wave infrared reflectometry. *IEEE PVSC*, 2019.

Patents

1. David P. Fenning, **Rishi E. Kumar**, and Guillaume Von Gastrow. Water reflection analysis of encapsulated photovoltaic modules, 2022.