

Dr. Benji Maruyama
Air Force Research Laboratory
Materials and Manufacturing Directorate
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Research Activities

Dr. Benji Maruyama is a Principal Materials Research Engineer in the Air Force Research Laboratory, Materials & Manufacturing Directorate, Autonomous Materials Lead & ACT3 (Autonomous Capabilities Team 3) Liaison lead. His focus area is the synthesis and processing science of carbon nanotubes using ARES™ which is the first fully Autonomous Research (ARES) Robot for materials. Dr. Maruyama's interests include the research process itself, for which he promotes the "Moore's Law for the speed of research". He is also the point of contact for carbon materials for the AFRL Materials & Manufacturing Directorate. His materials interests include carbon nanomaterials, energy storage, flexible-hybrid materials and processes, field emission, carbon, polymer and metal matrix composites, imaging of complex 3D microstructures and AI/Machine Learning. He is currently involved in the study of the origins of chiral growth for carbon nanotubes, defect engineering for low dimensional materials, catalysis and autonomous experimentation.

Appointments and Experience

Air Force Research Laboratory – Materials and Manufacturing Directorate

- Principal Materials Research Engineer 2018 – Present
- Senior Materials Research Engineer 2000 – 2017
- Materials Research Engineer 1996 – 2000
- *Chercheur Invité (Invited Full Professor) U. of Montpellier, France* 2011 – 2012
- *National Institute for Standards and Technology Co-located at Materials and Manufacturing Directorate*
- Materials Research Engineer 1993 – 1996
- *Centre National de la Recherche Scientifique*
- Chercheur Associé (Associate Researcher) 1991 – 1992
- Laboratoire Marcel Mathieu, Pau, France
- *National Academy of Sciences National Research Council*
- US Naval Research Laboratory Research Associate 1989 – 1991

Select Professional Activities

- Chair, AI for Materials Development Staging Committee, Materials Research Society
- Organizing Committee Co- Chair: Single Wall Carbon Nanotube Growth Mechanisms Workshop
- Founder and Organizer: Glen Helen Carbon Nanotube Collaborators Workshop
- Founder and Organizer: Autonomous Research Systems Workshops for Materials Development
- Former Member and Board President, Yellow Springs OH School District

Education

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|--------------------------------------|---|------|
| <i>University of Texas at Austin</i> | Ph.D., Materials Science & Engineering | 1989 |
| <i>University of Texas at Austin</i> | MS&E, Materials Science & Engineering | 1986 |
| <i>University of Pennsylvania</i> | B.S., Materials Science and Engineering | 1984 |

Honors and Awards

- Fellow, Air Force Research Laboratory. Inducted 2019
- Fellow, ASM-International. Inducted 2015
- Air Force Office of Scientific Research Star Team Member, 2014 & 2016
- Charles J. Cleary Scientific Achievement Award, 2009, 2016 and 2017
- AFRL Materials Directorate Robert T. Schwartz Engineering Expertise Award Winner, 2009
- Air Force John D McLucas Basic Science Award Finalist 2010
- General Ronald W. Yates Award for Excellence in Technology Transfer, 1997
- TMS Young Leader Award, 1997

Recent & Select Publications

- 1) Dee, Nicholas T; Li, Jinjing; White, Alvin Orbaek; Jacob, Christine; Shi, Wenbo; Kidambi, Piran R; Cui, Kehang; Zakharov, Dmitri N; Jankovič, Nina Z; Bedewy, Mostafa; , Carbon-assisted catalyst pretreatment enables straightforward synthesis of high-density carbon nanotube forests, *Carbon*, 153, 196-205, 2019, Pergamon
- 2) Kohlmeyer, Ryan R; Horrocks, Gregory A; Blake, Aaron J; Yu, Zhenning; Maruyama, Benji; Huang, Hong; Durstock, Michael F; , Pushing the thermal limits of Li-ion batteries, *Nano Energy*, 64, 103927, 2019, Elsevier
- 3) Islam, Ahmad Ehteshamul; Maruyama, Benji; , Single walled carbon nanotube triode, 2019, "US Patent 10, 431, 675"
- 4) Chen, Yimu; Lei, Yusheng; Li, Yuheng; Yu, Yugang; Cai, Jinze; Chiu, Ming-Hui; Rao, Rahul; Gu, Yue; Wang, Chunfeng; Choi, Woojin; , Strain engineering and epitaxial stabilization of halide perovskites, *Nature*, 577, 7789, 209-215, 2020, Nature Publishing Group
- 5) Li, Xu; Gray, Eric R; Islam, Ahmad E; Sargent, Gordon A; Maruyama, Benji; Amama, Placidus B; , Magnesia and Magnesium Aluminate Catalyst Substrates for Carbon Nanotube Carpet Growth, *ACS Applied Nano Materials*, 3, 2, 1830-1840, 2020, American Chemical Society
- 6) Islam, Ahmad Ehteshamul; Maruyama, Benji; , Single walled carbon nanotube triode and methods of using same, 2020, "US Patent 10, 577, 246"
- 7) Islam, Ahmad E; Martineau, Rhett; Crasto, Cameron M; Kim, Hyunil; Rao, Rahul S; Maruyama, Benji; Kim, Steve S; Drummy, Lawrence F; , Graphene-Based Electrolyte-Gated Field-Effect Transistors for Potentiometrically Sensing Neuropeptide Y in Physiologically Relevant Environments, *ACS Applied Nano Materials*, 3, 6, 5088-5097, 2020, American Chemical Society
- 8) Everhart, Brian M; Almkhelfe, Haider; Li, Xu; Wales, Michael; Nikolaev, Pavel; Rao, Rahul; Maruyama, Benji; Amama, Placidus B; , Efficient Growth of Carbon Nanotube Carpets Enabled by In Situ Generation of Water, *Industrial & Engineering Chemistry Research*, 59, 19, 9095-9104, 2020, American Chemical Society
- 9) Rao, Rahul; Carpena-Núñez, Jennifer; Dee, Nicholas T; Zakharov, Dmitri N; Boscoboinik, J Anibal; Stach, Eric A; Hart, A John; Maruyama, Benji; , Maximization of carbon nanotube yield by solid carbon-assisted dewetting of iron catalyst films, *Carbon*, 165, 251-258, 2020, Pergamon
- 10) Islam, Ahmad Ehteshamul; Susner, Michael A; Carpena-Núñez, Jennifer; Back, Tyson C; Rao, Rahul; Jiang, Jie; Pachter, Ruth; Tenney, Samuel A; Boeckl, John J; Maruyama, Benji; , Defect engineering of graphene using electron-beam chemistry with radiolyzed water, *Carbon*, 166, 446-455, 2020, Pergamon
- 11) Chang, Jorge; Nikolaev, Pavel; Carpena-Núñez, Jennifer; Rao, Rahul; Decker, Kevin; Islam, Ahmad E; Kim, Jiseob; Pitt, Mark A; Myung, Jay I; Maruyama, Benji; , Efficient closed-loop maximization of carbon nanotube growth rate using Bayesian optimization, *Scientific Reports*, 10, 1, 1-9, 2020, Nature Publishing Group
- 12) Carpena-Núñez, Jennifer; Rao, Rahul; Kim, Donghun; Bets, Ksenia V; Zakharov, Dmitri N; Boscoboinik, J Anibal; Stach, Eric A; Yakobson, Boris I; Tsapatsis, Michael; Stacchiola, Dario; , "Zeolite Nanosheets Stabilize Catalyst Particles to Promote the Growth of Thermodynamically Unfavorable, Small-Diameter Carbon Nanotubes", *Small*, 16, 38, 2002120, 2020,
- 13) Susner, MA; Rao, R; Pelton, AT; McLeod, MV; Maruyama, B; , Temperature-dependent Raman scattering and x-ray diffraction study of phase transitions in layered multiferroic CuCrP₂S₆, *Physical Review Materials*, 4, 10, 104003, 2020, American Physical Society

Issued Patents

- 14) Rao, Rahul S., and Benji Maruyama. "Inline spectroscopy for monitoring chemical vapor deposition processes." U.S. Patent No. 10,994,990. 4 May 2021.
- 15) Islam, Ahmad Ehteshamul, and Benji Maruyama. "Single walled carbon nanotube triode and methods of using same." U.S. Patent No. 10,577,246. 3 Mar. 2020.
- 16) "Method for enhancing growth of carbon nanotubes on substrates", Benji Maruyama, Gordon A. Sargent, Ahmad E. Islam, 2015, US-2015147525-A1
- 17) "Carbon nanotube fiber cathode", Steven B Fairchild, Benji Maruyama, 2014, US-2015147525-A1
- 18) "Method of processing filamentary nanocarbon", Benji Maruyama, 2009, US-8766522-B1
- 19) "Metal matrix composite material with high thermal conductivity and low coefficient of thermal expansion", Jonathan E. Spowart, Benji Maruyama, Daniel B. Miracle, 2008, US-7582275-B1
- 20) "Method for improving tensile properties of AlSiC composites", Jonathan E. Spowart, Benji Maruyama, Daniel B. Miracle, 2005, US-7364692-B1
- 21) "Method for making metal matrix composites", Benji Maruyama, 2000, US-6033622-A
- 22) "Using phosphorus compounds to protect carbon and silicon carbide from reacting with titanium alloys", Benji Maruyama, 1999, US-6033622-A
- 23) Morrish, A. A., Natishan, P. M., Maruyama, B., & Pehrsson, P. E. (1994). *U.S. Patent No. 5,374,414*. Washington, DC: U.S. Patent and Trademark Office.
- 24) Edelstein, A. S., Everett, R. K., Trzaskoma, P. P., & Maruyama, B. (1996). *U.S. Patent No. 5,494,634*. Washington, DC: U.S. Patent and Trademark Office.