

Kazi Moshir Rahman

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EDUCATION

- Virginia Tech** Blacksburg, VA
Ph.D., Mechanical Engineering August 2017 – December 2022
- **Advisor:** Christopher B. Williams
 - **Dissertation:** “Binder-Powder Interaction: Investigating the Process-Property Relations in Metal Binder Jetting”
- South Dakota State University** Brookings, SD
M.S., Mechanical Engineering August 2014 – August 2016
- **Advisor:** Todd M. Letcher
 - **Thesis:** “Effects of Defects on the Performance of Hierarchical Honeycomb Metamaterials realized through Additive Manufacturing”
- Islamic University of Technology** Gazipur, Bangladesh
B.S., Mechanical Engineering January 2009 – October 2012
- **Thesis:** “Electromagnetic Suspension System for Passenger Cars”

SUMMARY OF SKILLS

- Over 7 years of experience as a researcher in Manufacturing technologies including Material Extrusion, Binder Jetting Additive Manufacturing and Metal Casting
- Skilled in processing of powder metallurgy, and ceramics
- Skilled in multitude of materials characterization tools
- Demonstrated public engagement capacity through scientific and technical presentations

PROFESSIONAL POSITIONS

- Postdoctoral Research Associate** May 2023 - Present
Oak Ridge National Laboratory Knoxville, TN
- Graduate Research Assistant** June 2017 - December 2022
Virginia Tech DREAMS Lab Blacksburg, VA
- Graduate Research Assistant** August 2016 - May 2017
The University of Akron Akron, OH
- Graduate Teaching Assistant** August 2014 - May 2016
South Dakota State University Brookings, SD
- Sales Engineer, Product Support** February 2013 - June 2014
Kaltimex Energy Bangladesh (Pvt.) Ltd. Dhaka, Bangladesh

PUBLICATIONS

- **Rahman, K. M.**, Miyanaaji, H., and Williams, C.B. (2023) “The effects of powder particle size and binder droplet size on binder jetting part properties” *Rapid Prototyping Journal*
- **Rahman, K. M.**, Wei, A., Miyanaaji, H., and Williams, C.B. (2023) “Impact of Binder on Part Densification: Enhancing Binder Jetting Part Properties through the Fabrication of Shelled Geometries” *Additive Manufacturing*, 62, 103377
- **Rahman, K. M.**, and Williams, C.B. “Embedded anti-counterfeiting security signature in metal parts made through binder jetting.” *(to be submitted)*
- **Rahman, K. M.**, and Williams, C.B. “Influence of Binder-Powder Interaction on Accuracy and Resolution of Binder Jetting Parts.” *(to be submitted)*
- Miyanaaji, H., **Rahman, K. M.**, Da, M., and Williams, C. B. (2020). “Effect of fine powder particles on quality of binder jetting parts.” *Additive Manufacturing*, 36, 101587.

- **Rahman, K. M.**, Hu, Z., and Letcher, T. (2018). “In-plane stiffness of additively manufactured hierarchical honeycomb metamaterials with defects.” *Journal of Manufacturing Science and Engineering*, 140(1).
- **Rahman, K. M.**, Letcher, T., and Hu, Z. (2016, November). “Effects of defects on the performance of hierarchical honeycomb metamaterials realized through additive manufacturing.” In ASME International Mechanical Engineering Congress and Exposition (Vol. 50527, p. V002T02A028). American Society of Mechanical Engineers.
- **Rahman, K. M.**, Letcher, T., and Reese, R. (2015, November). “Mechanical properties of additively manufactured PEEK components using fused filament fabrication.” In ASME International Mechanical Engineering Congress and Exposition (Vol. 57359, p. V02AT02A009). American Society of Mechanical Engineers.
- Rasel, M. A. I., Siraj, S., and **Rahman, K. M.** (2012). “Prospect of renewable energy as the solution of the existing energy crisis of Bangladesh.” *International Journal of Scientific and Engineering Research*, 3, 3 -5, ISSN 2229-5518.

CONFERENCE PRESENTATIONS

- **Rahman, K.M.** and Williams, C.B (2023). “Providing Anti-counterfeiting Security in Binder Jetting through Tailored Porosity Signatures.” The 34th Annual International Solid Freeform Fabrication Symposium, August 14-16, 2023
- **Rahman, K.M.** and Williams, C.B (2022). “Influence of Binder-Powder Interaction on the Accuracy and Resolution of Binder Jetting Parts.” The 33rd Annual International Solid Freeform Fabrication Symposium, July 25-27, 2022
- Wei, A., **Rahman, K.M.**, and Williams, C.B (2022). “Increasing Part Strength and Density in Binder Jetting with Lattice Infill Patterning.” The 33rd Annual International Solid Freeform Fabrication Symposium, July 25-27, 2022
- **Rahman, K.M.**, Wei, A., Miyanaaji, H., and Williams, C.B (2021). “Selective Binder Jetting: Enhancing Part Quality through Fabrication of Shelled Geometries.” The 32nd Annual International Virtual Solid Freeform Fabrication Symposium, August 2-4, 2021
- Miyanaaji, H., **Rahman, K.M.**, Wei, A., and Williams, C.B (2019). “Binder Jetting of high strength copper parts using fine powder particles” The 32nd Annual International Virtual Solid Freeform Fabrication Symposium, August 12-14, 2019
- **Rahman, K. M.**, Letcher, T., and Hu, Z. (2016). “Effects of defects on the performance of hierarchical honeycomb metamaterials realized through additive manufacturing.” The ASME 2016 International Mechanical Engineering Congress and Exposition, November 11-17, 2016, Phoenix, Arizona, USA
- **Rahman, K. M.**, Letcher, T., and Reese, R. (2015). “Mechanical properties of additively manufactured PEEK components using fused filament fabrication.” The ASME 2015 International Mechanical Engineering Congress and Exposition, November 13-19, 2015, Houston, Texas

INVENTION DISCLOSURE

- Disclosure, **Rahman, K.M.** and Williams, C.B (2022), “Anti-counterfeiting Security Tag for Metal Binder Jetting Additive Manufacturing.” VTIP 22-161

CURRENT RESEARCH PROJECTS

Manufacturing Demonstration Facility

Oak Ridge National Laboratory

- **Emissol SBIR – Novel, Efficient Contactor Technology** (May 2022 – Present) ; **Role:** *Investigator*
 - * Investigate numerous powder feedstock and develop processing techniques using Binder Jet (BJT) Additive Manufacturing to manufacture Emissol’s proprietary emission control geometries
 - * Enable printing and depowdering of extremely fine and tortuous channels
- **Emissol Tech Collaboration** (May 2022 – Present) ; **Role:** *Investigator*
 - * Develop processing (printing and depowdering) techniques to achieve the resolution goal of 100 μ walls of Emissol’s proprietary geometries.

PAST RESEARCH PROJECTS

DREAMS Lab, Virginia Tech

May 2017 – December 2022

Blacksburg, VA

- **Binder Jetting of Stainless Steel 316L**
 - * Characterized the macro-scale effects of binder-powder interaction on part quality
- **Binder Jetting of Pure Copper**
 - * Developed processing guidelines for binder jetting of high quality copper parts with fine powders
 - * Characterized the impact of binder on the process-structure-property relations in metal binder jetting
 - * Developed and characterized a new technique for part quality enhancement in binder jetting
- **Additive Assisted Metal Casting of Cellular Structures**
 - * Designed and fabricated sand molds for cellular structures using binder jetting and casted Aluminum A356, Predicted the compressive strength of the casted structures

South Dakota State University

August 2014 – June 2016

Brookings, SD

- **Mechanical Behavior of Hierarchical Honeycomb Metamaterials**
 - * Characterized the behavior of self-similar hierarchical honeycomb metamaterials at different levels of hierarchy using ANSYS Mechanical APDL and experimentally validated the results on metamaterials fabricated using material extrusion additive manufacturing process
- **Topology Optimization for Additive Manufacturing**
 - * Designed and Optimized the topology of an automotive brake-pedal assembly using SolidThinking Inspire for both maximum stiffness and minimum mass to be fabricated through additive manufacturing
- **Structural Strength Evaluation and Optimization of a Bracket**
 - * Developed an algorithm to evaluate the structural strength of a 3D Bracket and optimized it for improved stress-strain distribution in the support component using ANSYS Mechanical APDL
- **Material Characterization of Composites**
 - * Developed an algorithm using ANSYS Mechanical APDL to estimate the strength of composites, properties of unidirectional ply and multidirectional layer of fiber reinforced polymer matrix composites
- **Simulation of a Fluidized Bed Reactor**
 - * Computationally evaluated the behavior of a typical fluidized bed reactor with different flow parameters using Star CCM+

Islamic University of Technology

May 2011 – October 2012

Gazipur, Bangladesh

- **Electromagnetic Suspension For Cars**
 - * Designed and built an electromagnetic suspension system prototype for passenger cars
- **Eco-Run Bangladesh (Funded by Japan International Cooperation Agency)**
 - * Helped in designing and building a fuel-efficient car and successfully participated in the test run

TEACHING EXPERIENCES

Graduate Teaching Assistant, Department of Mechanical Engineering

August 2014 – May 2016

South Dakota State University

Brookings, SD

- Introduction to Mechanical Design (ME 240) - Fall 2014, Spring 2015, Fall 2015
- Fundamentals of Machine Design (ME 321) - Fall 2015
- Thermodynamics I (ME 311) - Fall 2014, Spring 2015

Guest Lecturer, Department of Mechanical Engineering

South Dakota State University

Brookings, SD

- Fundamentals of Machine Design (ME 321)
 - * Dynamics Review
 - * Kinematics and Dynamics: Dynamic Force Analysis of a Landing Gear
 - * Kinematics and Dynamics: Dynamic Force Analysis of a Compressor
- Introduction to Mechanical Design (ME 240)

MENTORING ACTIVITIES

Virginia Tech, Blacksburg, VA

- Fall 2021 - Kendall Lippert, Undergraduate Student, Department of Materials Science and Engineering
- Spring 2020 - Lily Tran, Undergraduate Student, Department of Materials Science and Engineering
- Fall 2019 - Eric Link, Undergraduate Student, Department of Materials Science and Engineering

South Dakota State University, Brookings, SD

- Fall 2015 - Sai Rajkumer Vadla, Department of Mechanical Engineering

TECHNICAL SKILLS

Additive Manufacturing Systems

- ExOne Innovent/Innovent+ Binder Jetting System
- ExOne R2 Binder Jetting System
- ExOne X1-Lab Binder Jetting System
- 3D Systems Z350 Binder Jetting System
- Material Extrusion 3D Printing Systems

Materials Processing, Evaluation and Testing

- Powder Metallurgy Sintering
- Metallographic Sample Preparation
- Optical Microscopy
- Scanning Electron Microscopy
- Energy Dispersive Spectroscopy
- Optical Emission Spectroscopy
- Electron Backscatter Diffraction
- Particle Size Analysis
- Mechanical testing (Universal testing system; Charpy Impact; Rockwell Hardness)

Programming Languages: C, MATLAB

Engineering Applications: AutoCAD, ANSYS Mechanical APDL, ABAQUS, SolidWorks, nTopology, AutoDesk Netfabb, SolidThinking Inspire, Minitab, Star CCM+

HONORS/ACHIEVEMENTS

- Pratt Fellowship, 2019-2020 Academic Session, Department of Mechanical Engineering, Virginia Tech
- OIC (Organization of Islamic Conference) Scholarship for undergraduate studies, Islamic University of Technology, January 2009-October 2012
- Higher Secondary Level Education Board Scholarship, Board of Intermediate and Secondary Education, Dhaka, Bangladesh, January 2009-December 2012
- Secondary Level Education Board Scholarship, Board of Intermediate and Secondary Education, Jessore, Bangladesh, January 2006-December 2008
- Awarded Gold Medal from Dhuliapur Secondary School for breaking past records of academic performances in the history of the school
- Junior Level Scholarship from Bangladesh Govt., January 2004-December 2005
- Primary Level Scholarship from Bangladesh Govt., January 2001-December 2003
- Full Scholarship for Leadership Training at Bangladesh Youth Leadership Center (BYLC) from US Embassy-Bangladesh, November 2010-March 2011
- "PERFECT ATTENDANCE AWARD", Notre Dame College (2006-2008) and Dhuliapur Secondary School (5 years in a row from 2001 to 2005)

SERVICE/ COMMUNITY ACTIVITIES

- Member, American Society of Mechanical Engineers (ASME)
- Member, Society of Manufacturing Engineers (SME)
- November 2017, Volunteer, Virginia Science Festival, Moss Art Center, Virginia Tech
- Summer 2015, Instructor, Youth Engineering Adventure Camp, South Dakota State University, Brookings, SD
- December 2010-March 2011, Member of Team “Omuronon (Resonance)”, Established a School for underprivileged children at Korail, Dhaka in collaboration with Bangladesh Youth Leadership Center (BYLC)
- Volunteer, “National Immunization Day” campaign to make Polio free Bangladesh