# Dr. Ameya Rege

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## Employment History

2024 – · · · · **Assistant Professor.** University of Twente, Department of Mechanics of Solids, Surfaces & Systems, Enschede, the Netherlands.

2025 – · · · · **Adjunct Professor.** Indian Institute of Technology (IIT), Roorkee, India.

2022 – · · · · **Visiting Senior Lecturer.** Keele University, School of Computer Science and Mathematics, Staffordshire, United Kingdom.

2019 – · · · · **Scientist.** German Aerospace Center, Institute of Materials Research, Cologne, Germany. (Full-time: up to September 2024, since joining UT: ancillary activity)

2021 – 2024 **Research Group Leader.** German Aerospace Center, Institute of Materials Research, Cologne, Germany.

2012 – 2019 **Research and Teaching Assistant.** RWTH Aachen University, Department of Continuum Mechanics, Aachen, Germany.

## Education

2012 – 2018 **Ph.D., RWTH Aachen University** Mechanics.
Thesis title: *Mechanical Characterisation and Multiscale Modelling of Aerogels.*

2010 – 2012 **M.Sc., University of Southern California** in Aerospace Engineering.

2006 – 2010 **B.Eng., University of Mumbai** in Mechanical Engineering.

## Grants and awards

2024
- Acquired as co-I a collaborative project (with partners in Germany) funded by the Helmholtz Association under the Helmholtz MetaData Call - **200T Euros**.
- Acquired as coordinator and PI a collaborative project (with Canada) funded by the German Federal Ministry of Education and Research (BMBF) under the Bioeconomy International Call - **443T Euros**.
- Co-PI for a collaborative project (with India) funded by the German Academic Exchange Service (DAAD) - **11T Euros**.
- Co-PI for a project funded by the Helmholtz Association under the Helmholtz Enterprise Scheme - **230T Euros**.
- Co-I for a project funded by the UKRI under the EPSRC framework at Keele University with Dr Prikazchikova as the PI - **389T GBP**.
- Co-PI for a project funded by the Helmholtz Association under the Field Study Fellowship - **23T Euros**.

2023
- Finalist at the 2023 **Chemstars.NRW Lab to Market Challenge**.

2022
- Project coordinator and co-PI of a collaborative project (with diverse partners in EU) funded by the European Union under the Horizon 2020 Framework, Space Cluster - **750T Euros** (project - 3 million Euros).

## Grants and awards (continued)

- Project coordinator and co-PI of a collaborative project (with partners in Germany and Canada) funded by the German Federal Ministry of Education and Research (BMBF) under the Bioeconomy International Call - **383T Euros**.

2021 - **HPC Europa3** Fellowship awarded by the European Commission.

## Selected keynote / invited lectures / organised events

2025
- Organiser and invited tutorial speaker at the Aerogel Symposium, MRS Fall Meeting, Boston, USA.
- Organised the 3rd MSML conference, Keele University, UK.

2024
- Session keynote speaker at 9th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS), Lisbon, Portugal.
- Keynote speaker at 12th European Young Engineers Conference, Warsaw, Poland.
- Organised the 2nd MSML conference, Madrid, Spain.

2023
- Invited guest speaker at NASA Jet Propulsion Laboratory (JPL), Pasadena, USA; and at Lawrence Livermore National Laboratory, Livermore, USA.
- Invited speaker at the 16th International Conference on Advanced Computational Engineering and Experimenting, Crete, Greece.
- Organised the 1st International Seminar on Modelling, Simulation, and Machine Learning for Rapid Development of Porous Materials (MSML) conference, Cologne, Germany.
- Opening keynote speaker at Workshop on Characterisation and Modelling of Aerogels, Debrecen, Hungary.

2022
- Opening keynote speaker at the 6th International Seminar on Aerogels, Hamburg, Germany.

2019
- Invited speaker at the Materials Colloquium, Cologne, Germany.

2018
- Co-organised a Young Researchers Minisymposium at the 89th GAMM Annual Meeting, Munich, Germany.

## Research Publications

### Journal Articles


1. S. Aney, P. Pandit, L. Ratke, B. Milow, and A. Rege, "On the origin of power-scaling exponents in silica aerogels," *Journal of Sol-Gel Science and Technology*, vol. 114, pp. 98–105, 2025. DOI: 10.1007/s10971-023-06156-0.
2. S. Aney and A. Rege, "Network decomposition model to describe the solid and gaseous thermal conductivity in open-porous (nano) materials," *International Journal of Heat and Mass Transfer*, vol. 236, p. 126 316, 2025. DOI: 10.1016/j.ijheatmasstransfer.2024.126316.
3. R. Chandrasekaran, M. Itskov, and A. Rege, "Influence of the microstructure on the mechanical behavior of open-porous materials under large strains," *International Journal of Solids and Structures*, vol. 319, p. 113 441, 2025. DOI: 10.1016/j.ijsolstr.2025.113441.

4 J. Jarms, N. H. Borzecka, B. Serrador-Goncalves, K. Ganesan, B. Milow, and A. Rege, "Modeling of the gelation process in cellulose aerogels," *Biomacromolecules*, vol. 26, pp. 2199–2210, 2025. DOI: 10.1021/acs.biomac.4c01474.

5 A. Klawonn, M. Lanser, L. Mager, and A. Rege, "Computational homogenization for aerogel-like polydisperse open-porous materials using neural network–based surrogate models on the microscale," *Computational Mechanics*, not yet paginated, 2025. DOI: 10.1007/s00466-024-02588-9.

6 M. Zinke, B. Milow, G. Seide, and A. Rege, "Mechanical structure-property relations in flexible silica-aerogels," *under review*, 2025.

7 P. Pandit, R. Abdusalamov, M. Itskov, and A. Rege, "Deep reinforcement learning for microstructural optimisation of silica aerogels," *Scientific Reports*, vol. 14, p. 1511, 2024. DOI: 10.1038/s41598-024-51341-y.

8 H. Patel, J. Kröner, M. Schwan, B. Milow, and A. Rege, "Molecular description of mechanical structure–property relationships of nanostructured porous carbon," *The Journal of Physical Chemistry C*, vol. 128, pp. 21 245–21 252, 2024. DOI: 10.1021/acs.jpcc.4c07159.

9 L. Prikazchikova, A. Rege, J. Kaplunov, and D. Prikazchikov, "Low-frequency propagating and evanescent waves in strongly inhomogeneous sandwich plates," *Zeitschrift für angewandte Mathematik und Physik*, vol. 75, no. 6, pp. 1–14, 2024. DOI: 10.1007/s00033-024-02347-z.

10 S. Aney and A. Rege, "The effect of pore sizes on the elastic behaviour of open-porous cellular materials," *Mathematics and Mechanics of Solids*, vol. 28, no. 7, pp. 1624–1634, 2023. DOI: 10.1177/10812865221124.

11 T. Budtova, T. Lokki, S. Malakooti, *et al.*, "Acoustic properties of aerogels: Current status and prospects," *Advanced Engineering Materials*, vol. 25, no. 6, p. 2 201 137, 2023. DOI: 10.1002/adem.202201137.

12 A. Rege, "A perspective on methods to computationally design the morphology of aerogels," *Advanced Engineering Materials*, vol. 25, no. 1, p. 2 201 097, 2023. DOI: 10.1002/adem.202201097.

13 S. Aney, J. Schettler, M. Schwan, B. Milow, and A. Rege, "Insights into the micromechanics of organic aerogels based on experimental and modeling results," *Advanced Engineering Materials*, vol. 24, no. 1, p. 2 100 095, 2022. DOI: 10.1002/adem.202100095.

14 L. Ratke, A. Rege, and S. Aney, "The effect of particle necks on the mechanical properties of aerogels," *Materials*, vol. 16, no. 1, p. 230, 2022. DOI: 10.3390/ma16010230.

15 A. Rege, S. Aney, and L. Ratke, "Impact of pearl-necklace-like skeleton on pore sizes and mechanical properties of porous materials: A theoretical view," *AIP Advances*, vol. 12, no. 10, 2022. DOI: 10.1063/5.0112914.

16 R. Abdusalamov, P. Pandit, B. Milow, M. Itskov, and A. Rege, "Machine learning-based structure–property predictions in silica aerogels," *Soft Matter*, vol. 17, no. 31, pp. 7350–7358, 2021. DOI: 10.1039/D1SM00307K.

17 R. Abdusalamov, C. Scherdel, M. Itskov, B. Milow, G. Reichenauer, and A. Rege, "Modeling and simulation of the aggregation and the structural and mechanical properties of silica aerogels," *The Journal of Physical Chemistry B*, vol. 125, no. 7, pp. 1944–1950, 2021. DOI: 10.1021/acs.jpcb.0c10311.

18 R. Chandrasekaran, M. Hillgärtner, K. Ganesan, B. Milow, M. Itskov, and A. Rege, "Computational design of biopolymer aerogels and predictive modelling of their nanostructure and mechanical behaviour," *Scientific Reports*, vol. 11, no. 1, p. 10 198, 2021. DOI: 10.1038/s41598-021-89634-1.

19 İ. D. Külcü and A. Rege, "Physics-informed constitutive modelling of hydrated biopolymer aerogel networks," *Soft Matter*, vol. 17, no. 21, pp. 5278–5283, 2021. DOI: 10.1039/D1SM00430A.

20 A. Rege, "Constitutive modeling of the densification behavior in open-porous cellular solids," *Materials*, vol. 14, no. 11, p. 2731, 2021. DOI: 10.3390/ma14112731.

21 A. Rege, S. Aney, and B. Milow, "Influence of pore-size distributions and pore-wall mechanics on the mechanical behavior of cellular solids like aerogels," *Physical Review E*, vol. 103, no. 4, p. 043 001, 2021. DOI: 10.1103/PhysRevE.103.043001.

22 A. Rege and S. P. Patil, "On the molecular to continuum modeling of fiber-reinforced composites," *Advanced Theory and Simulations*, vol. 3, no. 4, p. 1 900 211, 2020. DOI: 10.1002/adts.201900211.

23 A. Rege, L. Ratke, İ. D. Külcü, and P. Gurikov, "Stiffening of biopolymer aerogel networks upon wetting: A model-based study," *Journal of non-crystalline solids*, vol. 531, p. 119 859, 2020. DOI: 10.1016/j.jnoncrysol.2019.119859.

24 A. Rege, M. Schwan, L. Chernova, M. Hillgärtner, M. Itskov, and B. Milow, "Microstructural and mechanical characterization of carbon aerogels: An in-situ and digital image correlation-based study," *Journal of Non-Crystalline Solids*, vol. 529, p. 119 568, 2020. DOI: 10.1016/j.jnoncrysol.2019.119568.

25 V. Santos-Rosales, G. Alvarez-Rivera, M. Hillgärtner, *et al.*, "Stability studies of starch aerogel formulations for biomedical applications," *Biomacromolecules*, vol. 21, no. 12, pp. 5336–5344, 2020. DOI: 10.1021/acs.biomac.0c01414.

26 A. Rege, M. Hillgärtner, and M. Itskov, "Mechanics of biopolymer aerogels based on microstructures generated from 2-d voronoi tessellations," *The Journal of Supercritical Fluids*, vol. 151, pp. 24–29, 2019. DOI: 10.1016/j.supflu.2019.04.018.

27 A. Rege, P. Voepel, E. Okumus, M. Hillgärtner, M. Itskov, and B. Milow, "Temperature-dependent stiffening and inelastic behavior of newly synthesized fiber-reinforced super flexible silica aerogels," *Materials*, vol. 12, no. 18, p. 2878, 2019. DOI: 10.3390/ma12182878.

28 S. P. Patil, A. Rege, M. Itskov, and B. Markert, "Fracture of silica aerogels: An all-atom simulation study," *Journal of Non-Crystalline Solids*, vol. 498, pp. 125–129, 2018. DOI: 10.1016/j.jnoncrysol.2018.06.005.

29 A. Rege and M. Itskov, "A microcell-based constitutive modeling of cellulose aerogels under tension," *Acta Mechanica*, vol. 229, pp. 585–593, 2018. DOI: 10.1007/s00707-017-1987-0.

30 A. Rege, I. Preibisch, M. Schestakow, *et al.*, "Correlating synthesis parameters to morphological entities: Predictive modeling of biopolymer aerogels," *Materials*, vol. 11, no. 9, p. 1670, 2018. DOI: 10.3390/ma11091670.

31 S. P. Patil, A. Rege, Sagardas, M. Itskov, and B. Markert, "Mechanics of nanostructured porous silica aerogel resulting from molecular dynamics simulations," *The Journal of Physical Chemistry B*, vol. 121, no. 22, pp. 5660–5668, 2017. DOI: 10.1021/acs.jpcb.7b03184.

32 R. Tannert, M. Schwan, A. Rege, *et al.*, "The three-dimensional structure of flexible resorcinol-formaldehyde aerogels investigated by means of holotomography," *Journal of Sol-Gel Science and Technology*, vol. 84, pp. 391–399, 2017. DOI: 10.1007/s10971-017-4363-6.

33 A. Rege, M. Schestakow, I. Karadagli, L. Ratke, and M. Itskov, "Micro-mechanical modelling of cellulose aerogels from molten salt hydrates," *Soft Matter*, vol. 12, no. 34, pp. 7079–7088, 2016. DOI: 10.1039/C6SM01460G.


## Books and Chapters


1 A. Rege and B. Milow, "Theoretical modeling of the thermal and mechanical structure-property relationships in aerogels," in *Aerogels for Energy Saving and Storage*, Wiley, 2024, pp. 473–496. DOI: 10.1002/9781119717645.ch16.

2 A. Rege, "Modeling the structural, fractal and mechanical properties of aerogels," in *Springer Handbook of Aerogels*, Springer, 2023, pp. 289–305. DOI: 10.1007/978-3-030-27322-4_12.

3. A. Rege, L. Ratke, and M. Itskov, "Modelling and simulations of polysaccharide and protein based aerogels," in *Biobased aerogels: Polysaccharide and protein-based materials*, Royal Society of Chemistry, 2018, pp. 129–150. DOI: 10.1039/9781782629979-00129.

## Full Papers in Conference Proceedings

1. W. Xiong, R. Abdusalamov, M. Itskov, B. Milow, and A. Rege, "Analysis of the microstructural connectivity and compressive behavior of particle aggregated silica aerogels," in *PAMM*, vol. 24, 2024, e202300224. DOI: 10.1002/pamm.202300224.
2. S. Aney, M. Schestakow, L. Prikazchikova, *et al.*, "Cellulose-aerogele als multifunktionale und nachhaltige alternativen für flugzeugkabinenelemente," in *Publikationen zum Deutschen Luft- und Raumfahrtkongress 2023, Stuttgart*, 2023. DOI: 10.25967/570245.
3. S. Aney, L. Ratke, B. Milow, and A. Rege, "Influence of pore-structure characteristics on the mechanical properties of open-porous cellular materials," in *PAMM*, vol. 22, 2023, e202200260. DOI: 10.1002/pamm.202200260.
4. R. Chandrasekaran, M. Hillgärtner, M. Itskov, and A. Rege, "Computational modelling of nanoporous materials," in *PAMM*, vol. 23, 2023, e202200187. DOI: 10.1002/pamm.202200187.
5. R. Chandrasekaran, M. Itskov, and A. Rege, "Importance of geometric parameters in modeling of porous materials–a finite element study," in *PAMM*, vol. 23, 2023, e202300194. DOI: 10.1002/pamm.202300194.
6. P. Pandit, R. Abdusalamov, M. Itskov, B. Milow, and A. Rege, "Data-driven inverse design and optimisation of silica aerogel model networks," in *PAMM*, vol. 23, 2023, e202200329. DOI: 10.1002/pamm.202200329.
7. R. Abdusalamov, M. Itskov, B. Milow, and A. Rege, "Analysis of the fractal properties of silica aerogels using diffusion-limited aggregation," in *PAMM*, vol. 20, 2021, e202000099. DOI: 10.1002/pamm.202000099.
8. R. Abdusalamov, P. Pandit, M. Itskov, B. Milow, and A. Rege, "Predictive modeling and simulation of silica aerogels by using aggregation algorithms," in *PAMM*, vol. 21, 2021, e202100165. DOI: 10.1002/pamm.202100165.
9. R. Chandrasekaran, M. Hillgärtner, A. Rege, B. Milow, and M. Itskov, "Geometric and finite element modeling of biopolymer aerogels to characterize their microstructural and mechanical properties," in *PAMM*, vol. 21, 2021, e202100122. DOI: 10.1002/pamm.202100122.
10. R. Chandrasekaran, M. Hillgärtner, A. Rege, B. Milow, and M. Itskov, "Modeling the microstructure of biopolymer aerogels using voronoi tessellation method," in *PAMM*, vol. 20, 2021, e202000102. DOI: 10.1002/pamm.202000102.
11. A. Rege, P. Gurikov, J. Kalmár, and B. Milow, "Perspectives in the modeling of biopolymer aerogel networks subject to wetting," in *PAMM*, vol. 20, 2021, e202000170. DOI: 10.1002/pamm.202000170.
12. C. Hesse, P. Allebrodt, and A. Rege, "Multi-physikalische untersuchungen zum transmissionsverhalten neuartiger kabinenseitenwände," in *Publikationen zum Deutschen Luft- und Raumfahrtkongress 2023, Online*, 2020. DOI: 10.25967/530130.
13. R. Abdusalamov, M. Itskov, B. Milow, G. Reichenauer, and A. Rege, "Investigation of the fractal properties of aerogels by diffusion-limited aggregation models," in *Proceedings of the 8th GACM Colloquium on Computational Mechanics*, 2019.
14. R. Chandrasekaran, M. Hillgärtner, B. Milow, M. Itskov, and A. Rege, "Application of voronoi tessellations to model cellular aerogels," in *Proceedings of the 8th GACM Colloquium on Computational Mechanics*, 2019.

15 A. Rege and M. Itskov, "A micro mechanical approach towards modeling the inelastic behaviour of fibre reinforced aerogels," in *Proceedings of the 6th GACM Colloquium on Computational Mechanics*, 2019.

16 A. Rege and M. Itskov, "An explanation of damage and failure in cellulose aerogels: Modeling approach," in *PAMM*, vol. 17, 2017, pp. 457–458. DOI: 10.1002/pamm.201710198.

17 A. Rege and M. Itskov, "Large strain constitutive modelling of cellulose aerogels," in *PAMM*, vol. 16, 2016, pp. 385–386. DOI: 10.1002/pamm.201610181.

18 A. Rege and M. Itskov, "Constitutive modeling of fiber-reinforced aerogels," in *PAMM*, vol. 15, 2015, pp. 347–348. DOI: 10.1002/pamm.201510164.

19 A. Rege, R. Dargazany, M. Itskov, and A. Deo, "An experimental study towards micro-mechanical modeling of fiber-reinforced aerogels," in *PAMM*, vol. 14, 2014, pp. 393–394. DOI: 10.1002/pamm.201410184.

20 R. Dargazany, A. Rege, and M. Itskov, "Elasticity of colloidal clusters with application to carbon-black aggregates in filled rubbers," in *Constitutive Models of Rubber*, vol. 8, 2013, pp. 261–266. DOI: 10.1002/pamm.201410184.

## Supervised PhD students

UT — Riya Sharma (2024 – 2028)

DLR — Shivangi Aney (2020-2024), Hemangi Patel (2022 – 2025), Prakul Pandit (2022 – 2025), Max Zinke (2022 – 2026).

## Selected journals where serving as a reviewer

Journals — Nature Communications, The Journal of Physical Chemistry, Scientific Reports, Journal of Applied Physics, Advanced Engineering Materials, Cellulose, Journal of Chemical Information and Modeling, Carbohydrate Polymers, International Journal of Thermal Sciences, ACS Applied Engineering Materials, IMA Journal of Applied Mathematics, Powder Technology, The Journal of Supercritical Fluids, Advanced Modeling and Simulation in Engineering Sciences, Results in Physics.

## Memberships at professional societies

Societies — Graduate School on Engineering Mechanics, GAMM (Association of Applied Mathematics and Mechanics), DPG (German Physical Society), DGM (German Materials Society) - group Micromechanics, DGLR (German Society for Aeronautics and Aerospace)