

Curriculum Vitae

Dr. Deepu J. Babu



Assistant Professor
Materials Science and Metallurgical Engineering
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Professional Experience

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|-------------------|---|
| 09/2020 – present | Assistant Professor, IIT Hyderabad
Department of Materials Science and Metallurgical Engineering |
| 12/2017 – 08/2020 | Postdoctoral Researcher - EPFL, Switzerland
Project: <i>Development of next generation inorganic and hybrid membranes for energy efficient gas separations.</i> |
| 11/2016 – 11/2017 | Postdoctoral Researcher - TU Darmstadt, Germany
Project: <i>Adsorption and wettability studies on carbon nanomaterials.</i> |

Education

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|------------------|---|---|
| 12/2011– 11/2016 | PhD - TU Darmstadt, Germany
Supervisor: Prof. Jörg J. Schneider
Title: <i>Gas adsorption studies on vertically aligned CNTs</i> | <i>Summa cum laude</i>
(passed with highest honours) |
| 7/2008 – 6/2011 | Master's - IIT Madras, India
Department of Metallurgy and Materials Engineering
Supervisor: Prof. S. S. Bhattacharya (IIT M, India) and Prof. Horst Hahn (TU Darmstadt, Germany)
Title: <i>Flame spray synthesis of $La_{0.75}Sr_{0.2}MnO_3$ nanoparticles for solid oxide fuel cell cathodes.</i> | CGPA: 9.2/10 |
| 9/2004 – 5/2008 | B.Tech. - Kerala University, Kerala, India
Department of Mechanical Engineering
Supervisor: Prof. Reby Roy (TKMCE, Kollam) and Dr. S. Savithri (NIIST, Trivandrum).
Project: <i>Simulation of nanoparticle production in premixed aerosol flow reactors by interfacing fluid mechanics and particle dynamics.</i> | First class with distinction |

Teaching Experience

08/2011 – 09/2011 | Faculty at Mechanical Engineering department, Amal Jyothi College of Engineering, M.G. University, Kerala, India.

Research Experience

Research interests	<ul style="list-style-type: none">• Nanoporous materials• Gas adsorption/separation• Defect Engineering in porous materials• Plasma functionalization• Superhydrophobic and superhydrophilic surfaces• Active membrane separation
Materials	<ul style="list-style-type: none">• Carbon nanomaterials: carbon nanotubes (CNT), graphene, graphene oxide (GO), carbon nanohorns (CNH), hierarchical carbon materials• Metal-Organic Frameworks (MOFs): ZIF-7, ZIF-8, ZIF-67, UiO-66• Ceramic nanoparticles: alumina, titania, lanthanum strontium manganate• Polymers: phase inversion process, polymeric membranes
Synthesis and thin film techniques	<ul style="list-style-type: none">• Flame spray pyrolysis, nebular spray pyrolysis and chemical vapor synthesis of ceramic nanoparticles• Chemical vapor deposition (CVD) synthesis of CNT• CVD synthesis of graphene• Solvothermal synthesis of MOF• Electrophoretic deposition of MOF• Thermal evaporation, sputtering, electron beam deposition
Characterizations	<ul style="list-style-type: none">• Diffraction techniques: XRD and electron diffraction• Spectroscopic techniques: XPS, Raman, FTIR, photoluminescence, EDX• Microscopy: Optical, SEM and confocal fluorescence microscopy• Porosity measurements: N₂ adsorption measurements, CO₂ adsorption measurements, BET analysis, pore size distribution analysis• Other techniques: contact angle measurements, contact angle hysteresis measurements, dynamic light scattering measurements
Lab setting	<ul style="list-style-type: none">• Design and setting up of a high pressure (≤ 100 bar) gas adsorption setup• CVD setup for CNT synthesis• Design and setting up of a gas permeation setup• Design and setting up of a vapor phase reactor setup for MOF synthesis
Research guidance	<ul style="list-style-type: none">• 3 student projects during PhD period• 5 student projects during postdoctoral period

Leadership

- Discussion leader for GRC conference on Carbon, Capture and Utilization, May 5 – 10, 2019, Les Diablerets, Switzerland.
- Main student co-ordinator for a national level technical symposium during Bachelor studies
- Mechanical association secretary in Bachelor studies
- Head of student body of training and placement cell during B. Tech.

Invited talks

- Talk at IIT, Hyderabad, 14th January 2020
- Talk at M. G. University, 7th January 2020
- Talk at NIT, Calicut, 3rd January 2019

Awards and Honours

- Second prize for oral presentation at Swiss Chemical Society Fall 2019.
- *Summa cum laude* for PhD
- Shortlisted for *Kurt-Ruths-Preis 2017* for best PhD thesis
- Cover page article in *Advanced Materials Interfaces* journal
- Featured article in *Journal of Chemical Physics*
- Recipient of DAAD travel grant for conference in USA
- Recipient of DAAD IIT Master-sandwich scholarship
- Best outgoing Mechanical Engineering student in Bachelor's
- First prize for group science project in school class XII

Additional Information

Languages

English, German (A2), Malayalam (mother tongue), Hindi, Tamil.

Extra-curricular activities

Travelling, Reading, Cricket and Table Tennis

Hyderabad, 6th October, 2020



Deepu J. Babu

LIST OF PUBLICATIONS, PATENTS, CONFERENCES AND MULTIMEDIA PRESENTATIONS

Publications

1. Liu, Q.; **Babu, D. J.**; Hao, J.; Vahdat, M. T.; Campi, D.; Agrawal, K. V. [Metal Soap Membranes for Gas Separation](#). *Advanced Functional Materials*, **2020**, 2005629, Just Accepted. (Impact factor: 16.8)
2. Hao, J.; **Babu, D. J.***; Liu, Q.; Lu, C.; Liu, Y.; Agrawal, K. V.* [Synthesis of high-performance polycrystalline metal-organic framework membranes at room temperature in a few minutes](#). *J. Mater. Chem. A* **2020**, 8, 7633-7640. (Impact factor: 11.3) [*Corresponding author]
3. **Babu, D. J.**; He, G.; Hao, J.; Vahdat, M. T.; Schouwink, P. A.; Mensi, M.; Agrawal, K. V. [Restricting Lattice Flexibility in Polycrystalline Metal-Organic Framework Membranes for Carbon Capture](#). *Adv. Mater.* **2019**, 31 (28) 1900855. (Impact factor: 27.4)
4. Huang, S.; Villalobos, L. F.; **Babu, D. J.**; He, G.; Li, M.; Züttel, A.; Agrawal, K. V. [Ultrathin Carbon Molecular Sieve Films and Room-Temperature Oxygen Functionalization for Gas-Sieving](#). *ACS Appl. Mater. Interfaces* **2019**, 11 (18), 16729–16736. (Impact factor: 8.7)
5. Dixon, D.; **Babu, D. J.**; Bhaskar, A.; Bruns, H.-M.; Schneider, J. J.; Scheiba, F.; Ehrenberg, H. [Tuning the Performance of Vanadium Redox Flow Batteries by Modifying the Structural Defects of the Carbon Felt Electrode](#). *Beilstein J. Nanotechnol.* **2019**, 10 (1), 1698–1706. (Impact factor: 2.4)
6. **Babu, D. J.†**; He, G.†; Villalobos, L. F.†; Agrawal, K. V. [Crystal Engineering of Metal–Organic Framework Thin Films for Gas Separations](#). *ACS Sustain. Chem. Eng.* **2019**, 7 (1), 49–69. †Equal contribution. (Impact factor: 7.6)
7. He, G.; **Babu, D. J.**; Agrawal, K. V. [Electrophoretic Crystallization of Ultrathin High-Performance Metal-Organic Framework Membranes](#). *J. Vis. Exp.* **2018**, 138, e58301. (Impact factor: 1.3)
8. **Babu, D. J.†**; Puthusseri, D.†; Kühl, F. G.†; Okeil, S.; Bruns, M.; Hampe, M.; Schneider, J. J. [SO₂ Gas Adsorption on Carbon Nanomaterials: A Comparative Study](#). *Beilstein J. Nanotechnol.* **2018**, 9, 1782–1792. †Equal contribution. (Impact factor: 2.4)

9. Thomson, M. D.; Zouaghi, W.; Meng, F.; Wiecha, M. M.; Rabia, K.; Heinlein, T.; Hussein, L.; **Babu, D. J.**; Yadav, S.; Engstler, J.; et al. [Dielectric Properties of Vertically Aligned Multi-Walled Carbon Nanotubes in the Terahertz and Mid-Infrared Range](#). *J. Phys. D. Appl. Phys.* **2018** *51*, 034004. (Impact factor: 3.2)
10. **Babu, D. J.**; Bruns, M.; Schneider, J. J. [Unprecedented CO₂ Uptake in Vertically Aligned Carbon Nanotubes](#). *Carbon* **2017**, *125*, 327–335. (Impact factor: 8.8)
11. **Babu, D. J.**; Schneider, J. J. [Gas Adsorption Studies of CO₂ in Carbon Nanomaterials: A Case Study of Vertically Aligned Carbon Nanotubes](#). *Chemie Ing. Tech.* **2017**, *89* (10), 1273–1287. (Impact factor: 1.1)
12. Puthusseri, D.[†]; **Babu, D. J.**[†]; Okeil, S.; Schneider, J. J. [Gas Adsorption Capacity in an All Carbon Nanomaterial Composed of Carbon Nanohorns and Vertically Aligned Carbon Nanotubes](#). *Phys. Chem. Chem. Phys.* **2017**, *19* (38), 26265–26271. [†]Equal contribution. (Impact factor: 3.6)
13. **Babu, D. J.**[†]; Mail, M.[†]; Barthlott, W.; Schneider, J. J. [Superhydrophobic Vertically Aligned Carbon Nanotubes for Biomimetic Air Retention Under Water \(*Salvinia effect*\)](#). *Adv. Mater. Interfaces* **2017**, *4*(13), 1700273 [**Cover Page**]. [†]Equal contribution. (Impact factor: 4.9)
14. **Babu, D. J.**; Bruns, M.; Schneider, R.; Staudt, R.; Schneider, J. J. [Understanding the Influence of N-Doping on the CO₂ Adsorption Characteristics in Carbon Nanomaterials](#). *J. Phys. Chem. C*, **2017**, *121* (1), 616–626. (Impact factor: 4.2)
15. Patzsch, J.; **Babu, D. J.**; Schneider, J. J. [Hierarchically Structured Nanoporous Carbon Tubes for High Pressure Carbon Dioxide Adsorption](#). *Beilstein J. Nanotechnol.* **2017**, *8* (1), 1135–1144. (Impact factor: 2.4)
16. **Babu**[†], **D. J.**; Herdt[†], T.; Okeil, S.; Bruns, M.; Staudt, R.; Schneider, J. J. [Bud Type Carbon Nanohorns. Materials for High Pressure CO₂ Capture and Li-Ion Storage](#). *J. Mater. Chem. A* **2016**, *4* (37), 14267-14275. [†]Equal contribution. (Impact factor: 11.3)
17. Dixon, D.; **Babu, D.J.**; Langner J.; Bruns, M.; Pfaffmann, L.; Bhaskar, A.; Schneider, J. J.; Scheiba, F.; Ehrenberg, H.; [Effect of oxygen plasma treatment on the electrochemical performance of the rayon and](#)

- polyacrylonitrile based carbon felt for the vanadium redox flow battery application. *J. Power Sources* **2016**, *332*, 240–248. (Impact factor: 7.4)
18. **Babu**[†], **D. J.**; Kühl[†], F. G.; Yadav, S.; Markert, D.; Bruns, M.; Hampe, M. J.; Schneider, J. J. Adsorption of Pure SO₂ on Nanoscaled Graphene Oxide. *RSC Adv.* **2016**, *6* (43), 36834–36839. [†]Equal contribution. (Impact factor: 3.1)
19. Rahimi[†], M.; **Babu**[†], **D. J.**; Singh, J. K.; Yang, Y.-B.; Schneider, J. J.; Müller-Plathe, F. Double-Walled Carbon Nanotube Array for CO₂ and SO₂ Adsorption. *J. Chem. Phys.* **2015**, *143* (12), 124701. [†]Equal contribution. [*Featured Article*] (Impact factor: 3.0)
20. **Babu**, **D. J.**; Yadav, S.; Heinlein, T.; Cherkashinin, G.; Schneider, J. J. Carbon Dioxide Plasma as a Versatile Medium for Purification and Functionalization of Vertically Aligned Carbon Nanotubes. *J. Phys. Chem. C* **2014**, *118* (22), 12028–12034. (Impact factor: 4.2)
21. **Babu**[†], **D. J.**; Varanakkottu[†], S. N.; Eifert[†], A.; de Koning, D.; Cherkashinin, G.; Hardt, S.; Schneider, J. J. Inscribing Wettability Gradients Onto Superhydrophobic Carbon Nanotube Surfaces. *Adv. Mater. Interfaces* **2014**, *1* (2). [†]Equal contribution. (Impact factor: 4.9)
22. **Babu**, **D. J.**; Lange, M.; Cherkashinin, G.; Issanin, A.; Staudt, R.; Schneider, J. J. Gas Adsorption Studies of CO₂ and N₂ in Spatially Aligned Double-Walled Carbon Nanotube Arrays. *Carbon* **2013**, *61*, 616–623. (Impact factor: 8.8)
23. Rahimi, M.; Singh, J.; **Babu**, **D. J.**; Schneider, J. J.; Müller-Plathe, F. Understanding Carbon Dioxide Adsorption in Carbon Nanotube Arrays: Molecular Simulation and Adsorption Measurements. *J. Phys. Chem. C* **2013**, *117*, 13492–13501. (Impact factor: 4.2)
24. Weidler, N.; **Babu**, **D. J.**; Martinaiou, I.; Paul, S.; Wagner, S.; Shahraei, A.; Janßen, A.; Stark, R. W.; Schneider, J. J.; Kramm, U. I. Effect of RF-Plasma Treatment on the Activity and Selectivity of Me-N-C Electrocatalysts for the Oxygen Reduction Reaction. *ECS Trans.* **2017**, *80* (8), 691–700.
25. **Babu**, **D. J.**; Darbandi, A. J.; Suffner, J.; Bhattacharya, S. S.; Hahn, H. Flame Spray Synthesis of Nano Lanthanum Strontium Manganite for Solid Oxide Fuel Cell Applications. *Trans. Indian Inst. Met.* **2011**, *64* (1–2), 181–184. (Impact factor: 1.2).

Patents

1. **Babu, D. J.**; Villalobos, L. F.; and Agrawal, K. V. Method of preparation of porous polymeric support layer and uses thereof. (Patent Application No. EP20174809.2).

Conferences

1. **Babu, D. J.** and Agrawal, K. V. *North American Membrane Society (NAMS) conference*, May 18 - 21, 2020, Online (Poster).
2. **Babu, D. J.** and Agrawal, K. V. *Beilstein Nanotechnology Symposium*, November 12 - 14, 2019, Rüdeshheim, Germany (Poster).
3. **Babu, D. J.** and Agrawal, K. V. *Swiss Chemical Society Fall Meeting*, September 6, 2019, Zurich, Switzerland (Oral).
4. **Babu, D. J.** and Agrawal, K. V. *GRC on Nanoporous Materials and Their Applications*, August 4 – 9, 2019, Andover, NH, USA (Poster).
5. **Babu, D. J.** and Agrawal, K. V. *GRC on Carbon Capture, Utilization and Storage*, May 5 – 10, 2019, Les Diablerets, Switzerland (Poster).
6. **Babu, D. J.** He, G., and Agrawal, K. V. *Swiss Chemical Society Fall Meeting*, September 7, 2018, EPFL, Switzerland (Oral).
7. **Babu, D. J.** and Schneider J. J. *Deutsche Zeolith Tagung*, March 02 - 04, 2016, Gießen, Germany (Oral).
8. **Babu, D. J.** and Schneider J. J. *MRS Fall Meeting*, November 29 - December 4, 2015, Boston, USA (Oral).
9. **Babu, D. J.** and Schneider J. J. 6. *Doktorandenseminar Adsorption* (Organized by Max-Planck-Institut für Dynamik Komplexer Technischer Systeme, Magdeburg), August 25 - 26, 2015, Magdeburg, Germany (Oral).
10. **Babu, D. J.** and Schneider J. J.. 5. *Doktorandenseminar Adsorption* (Organized by Hochschule Offenburg and ProcessNet), September 23 - 24, 2014, Offenburg, Germany (Oral).
11. **Babu, D. J.**; Rahimi, M.; Müller-Plathe, F.; Staudt, R.; Schneider, J. J. *Jahrestreffen der Fachgruppe Adsorption* March 5 - 6, 2014, Fulda, Germany (Poster).
12. **Babu, D. J.**; Darbandi. A. J.; Suffner, J.; Bhattacharya, S. S.; Hahn, H. *International Symposium for Research Scholars (ISRS)-2010*, December 20 – 22, 2010, IIT Madras, India (Oral).

MULTIMEDIA

- Schneider, J.J. & **Babu, D.J.**, 2014. [Mimicking Natural Surface Wettability with 3D Carbon Nanoarchitectures](#). *Beilstein TV*.