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RESEARCH INTEREST

- Alternative Fuels (Alcohols, DME, H_2, CNG)
- Advanced Combustion Technology
- Emission Characterization
- Spray Characterization
- LASER Ignition
- Material Compatibility and Design Consideration for Alternative Fuels
- IC Engine Tribology
- Tribology, Nanomaterials, Polymers, Composites, and Coating

SKILLS

- 3D Simulation
- Spray Characterization (Macro and Micro)
- ECU Tuning
- Eddy Current and Transient Dynamometer
- Engine Exhaust Particulate Sizer (EEPS)
- Combustion and Emission Analyzer
- Various Transducers and Sensors
- Particulate Matter Sampling and SEM/TEM Characterization
- 3D Profiler, AFM, Design, and development of Tribometer, Soft and Hard Coatings, Tribology.

WORK EXPERIENCE

I have performed many experimental investigations to develop alternative (alcohols and DME) fuelled engines. I have worked closely with the doctoral researcher and lab technician to maintain the operation of the engine testing facilities and instrumentations. I have mentored many master's, Ph.D., and undergraduate students. I have project writing and project report preparation experience. I have experience in project writing for a grant from industries and research supporting government institutions.

RESEARCH EXPERIENCE **(7th April 2018 to till now)**
2nd August 2021 onwards: Project Scientist, IIT Kanpur, India.
1st August 2018 to 31st July 2021: SRA, CSIR 'Pool Scientist', IIT Kanpur, India.
7th April 2018 to 21st July 2018: Senior Project Engineer, IIT Kanpur, India.

Post-Doctoral Research

Mentor: Prof. Avinash Kumar Agarwal
Indian Institute of Technology Kanpur, Kanpur, India

- **"Prototype Development of DME (Dimethyl ether) Fuelled Tractor"** in Industrial collaboration with Tractors and Farm Equipment (TAFE) Limited India.
- "**Development of Methanol Fuelled (dual-fuel) Engines**" I have completed the project sponsored by **CSIR-HRDG**, in which I have successfully developed methanol fuelled Genset by replacing 90%diesel with methanol.
- NITI Aayog Methanol Economy related project "**Development of methanol fuelled turbocharged CRDI engine**."
- Material compatibility, fuel injection system design, and tribological solution for applying alternative fuels (methanol and DME) in engines.
- Advanced combustion technology, RCCI (reactivity control compression ignition technique) for applying low reactivity fuels (gasoline and alcohols) in CI engines to improve combustion efficiency, brake thermal efficiency, and lower harmful emissions.

EDUCATION

Ph.D. (Mechanical) (2018)

Indian Institute of Technology Kanpur, Kanpur (UP), India

Supervisors: **Prof. Sujeet Kumar Sinha**
Nano-Bi-Tribology Laboratory, Indian Institute of Technology Delhi, India
Prof. Avinash Kumar Agarwal
Engine Research Laboratory, Indian Institute of Technology Kanpur, India

Title: *Enhancement of Tribological Properties of Epoxy Composite Coatings for Engine Applications*

Research Synopsis: My Ph.D. work involved applying polymer coatings to reduce friction and wear in extreme contact conditions. The research's main motive was to perform experimental investigations and find alternative solutions for enhancing the tribological performance of lubricants and components without using harmful additives. This work optimized lubricant-filled epoxy-based composite coatings for load-bearing applications such as journal bearings, engine piston rings, and similar configurations. These coatings work well under dry contact conditions and external liquid lubrication conditions.

Master of Engineering (Mechanical) (2011)

University Institute of Technology, RGPV Bhopal (MP), India

Supervisor: Prof. Aseem Chandra Tiwari
Department of Mechanical Engineering, UIT, RGPV Bhopal, India.

Title: Experimental Investigation of Performance Parameters of the Single Cylinder Four Stroke Diesel Engine with Lean Coconut Biodiesel-Diesel Blend as Fuel.

Bachelor of Engineering (Mechanical) (2009)

College of Engineering, BVU Pune (Maharashtra), India

PUBLICATIONS [Web of Science Researcher ID: AAT-9397-2021, Scopus ID: 57191265813]

Journal Papers [Cumulative Impact Factor: 102.48]

1. Nalini Kanta Mukherjee, Hardikk Valera, Sarat Unnithan, Vikram Kumar, Vipin Dhyani, Shanti Mehra, Rahul Kumar Singh, Devendra Nene, Avinash Kumar Agarwal. Feasibility Study of Novel DME Fuel Injection Equipment: Part 1- Fuel Injection Strategies and Spray Characteristics. Fuel, April 2022, 233:124333. (Accepted) DOI: 10.1016/j.fuel.2022.124333 (Q1, IP=8.035)
2. Nalini Kanta Mukherjee, Hardikk Valera, Sarat Unnithan, Vikram Kumar, Vipin Dhyani, Shanti Mehra, Ayush Tripathi, Devendra Nene, Avinash Kumar Agarwal. Feasibility Study of Novel DME Fuel Injection Equipment: Part 2- Performance, Combustion, Regulated and Unregulated Emissions. Fuel, April 2022, 233:124338. (Accepted) DOI: 10.1016/j.fuel.2022.124338 (Q1, IP=8.035)

3. Agarwal AK, **Kumar V**. Jena A, Kalwar A. Fuel Injection Strategy Optimisation and Experimental Performance and Emissions Evaluation of Diesel Displacement by Port Fuel Injected Methanol in a Retrofitted Mid-Size Genset Engine Prototype. Energy, February 2022; 248:123593. 10.1016/j.energy.2022.123593. (Q1, IP= 8.857)
4. Singh AP, **Kumar V**, Agarwal AK. Reactivity Controlled Compression Ignition Engine Operated at Different Intake Charge Temperatures and Exhaust Gas Recirculation Rates. SAE International Journal of Engines 2021; 14(6):03-14-06-0046. DOI:10.4271/03-14-06-0046. (Q1, IP=1.867)
5. Singh AP, **Kumar V**, Agarwal AK. Reactivity Controlled Compression Ignition Engine Operated at Different Intake Charge Temperatures and Exhaust Gas Recirculation Rates. SAE International Journal of Engines 2021; 14(6):03-14-06-0046. DOI:10.4271/03-14-06-0046. (Q1, IP=1.867)
6. Singh AP, **Kumar V**, Agarwal AK. *Evaluation of Reactivity Controlled Compression Ignition Mode Combustion Engine Using Mineral Diesel/ Gasoline Fuel Pair*. Fuel 2021; 301:120986. DOI: 10.1016/j.fuel.2021.120986 (Q1, IP=8.035)
7. Agarwal AK, Singh AP, **Kumar V**. Comparative Investigations of Particulate Matter Characteristics of Low Temperature Combustion (PCCI and RCCI) Modes with Compression Ignition Mode Combustion. Environmental Pollution 2021; 284:117375. DOI: 10.1016/j.envpol.2021.117375. (Q1, IP=9.98)
8. Agarwal AK, Singh AP, **Kumar V**. Reactivity Controlled Compression Ignition Engine Fuelled with Mineral Diesel and Butanol at different Premixed Ratios and Varying Loads. Journal of Energy Resources Technology 2022; 144(2): 022304. DOI: 10.1115/1.4051037. (Q2, IP=3.09)
9. Singh AP, **Kumar V**, Agarwal AK. *Evaluation of Comparative Engine Combustion, Performance and Emission Characteristics of Low Temperature Combustion (PCCI and RCCI) Modes with Compression Ignition Mode Combustion*. Applied Energy 2020; 278:115644. DOI: 10.1016/j.apenergy.2020.115644. (Q1, IP= 11.566)
10. **Kumar V**, Singh AP, Agarwal AK. *Particulate and Unregulated Emission Characteristics of a Medium-Duty Diesel Engine Using Diesel-Alcohol Blends*. Fuel 2020; 278:118269. DOI: 10.1016/j.fuel.2020.118269. (Q1, IP=8.035)
11. Singh AP, Sharma N, **Kumar V**, Agarwal AK. *Mineral Diesel/Methanol-Fueled Reactivity Controlled Compression Ignition Engine Operated at Different Engine Loads and Premixed Ratios.* International Journal of Engine Research 2020; 22(7): 2375-2389. DOI: 10.1177/1468087420923451. (Q2, IP=3.221)
12. Singh AP, Sharma N, **Kumar V**, Satsangi DP, Agarwal AK. *Fuel Injection Strategy for Utilization of Mineral Diesel-Methanol Blend in a Common Rail Direct Injection Engine*. Journal of Energy Resources Technology 2019; 142(8):082305. DOI: 10.1115/1.4046225. (Q2, IP=3.09)
13. Agarwal AK, Singh AP, Sharma N, **Kumar V**, Satsangi DP, Patel C. *Adaptation of Methanol-Dodecanol-Diesel Blend in Diesel Genset Engine.* Journal of Energy Resources Technology 2019; 141(10):102203. DOI: 10.1115/1.4043390. (Q2, IP=3.09)
14. Pandey A, Patel A, Ariharan S, **Kumar V**, Sharma R, Kanhed S, Nigam V, Keshri A, Agarwal A, Balani K. *Enhanced Tribological and Bacterial Resistance of Carbon Nanotube, Ceria and Silver Incorporated Hydroxyapatite Biocoating*. Nanomaterials 2018; 8:363. DOI: 10.3390/nano8060363. (Q1, IP=5.719)
15. **Kumar V**, Sinha SK, Agarwal AK. Wear investigation of piston rings over coated with bilayer hard and soft polymer composites. ASME, Journal of Tribology 2019; 141(3):031301. DOI: 10.1115/1.4041762. (Q2, IP=2.045)
16. **Kumar V**, Sinha SK, Agarwal AK. *Tribological performance of dual-coating (intermediate hard with top epoxy composite) in dry and lubricated conditions.* Tribology International 2018; 127:10-23. DOI: 10.1016/j.triboint.2018.05.011. (Q1, IP=5.62)
17. **Kumar V**, Sinha SK, Agarwal AK. *Tribological characterization of epoxy-graphene-liquid filler composite coatings on steel under base oil external lubrication.* Tribology-Material Surface & Interface 2018; 12(3) 144-156. DOI: 10.1080/17515831.2018.1482719. (Q2, IP=2.35)
18. **Kumar V**, Sinha SK, Agarwal AK. *Tribological studies of epoxy composites with solid and liquid fillers.* Tribology International 2017; 105:27-36. DOI: 10.1016/j.triboint.2016.09.010. (Q1, IP=5.62)

19. **Kumar V**, Sinha SK, Agarwal AK. *Tribological studies of epoxy and its composite coatings on steel in dry and lubricated sliding*. Tribology-Material Surface & Interface 2015; 9(3):144-153. DOI: 10.1179/1751584X15Y.0000000015. (Q2, IP=2.35)

Journal Papers Communicated

1. Agarwal AK, Singh AP, Kumar V. Effect of Pilot Injection Strategy on the Methanol-Mineral Diesel Fueled Reactivity Controlled Compression Ignition Combustion Engine. Fuel, 29 August 2022; JFUE-D-22-07499.
2. Agarwal AK, Kumar V, Singh AP. Alcohols as Future Fuels for Transport Sector. Renewable and Sustainable Energy Reviews, 29 August 2022; RSER-D-22-04452.
3. Kumar V, Shanti Mehra, Hardikk Valera, Agarwal AK. Comparative Study of Microscopic Spray Characteristics of Dimethyl Ether (DME) with Diesel in Atmospheric Ambient Conditions. Atomization and Spray, 22 September 2022.

CONFERENCES

Invited Talk

1. **Kumar V**. *New Approach for Environment Friendly Lubrication*. Third International Conference on Sustainable Energy and Environmental Challenges (III-SEEC), IIT Roorkee, December 18-21, 2018.

Contributed Talk

1. **Kumar V**, Agarwal AK. *Emission Characteristics of Methanol Fuelled Genset Engine.* Proceedings of the International Conference on Sustainable Energy and Environmental Challenges (VI-SEEC), LUCKNOW, November 27-29, 2021.
2. **Kumar V**, Agarwal AK. *Performance and Emission Characteristics of a Diesel Engine Using Diesel-Alcohol Blends*. Proceedings of the International Conference on Sustainable Energy and Environmental Challenges (IV-SEEC), NEERI Nagpur, November 27-29, 2019.
3. **Kumar V**, Agarwal AK. *Performance and Emission Analysis of Methanol Fueled Genset*. Proceedings of the International Conference on Sustainable Energy and Environmental Challenges (III-SEEC), IIT Roorkee, December 18-21, 2018.
4. **Kumar V**, Agarwal AK. *Optimization of Methanol Powered Internal Combustion Engine*. Proceedings of the International Conference on Sustainable Energy and Environmental Challenges (III-SEEC), IIT Roorkee, December 18-21, 2018.
5. **Kumar V**, Sinha SK, Agarwal AK. *Tribological investigation of hard coating on steel*. Proceedings of the International Conference on Sustainable Energy and Environmental Challenges (SEEC-2018), Bangalore (India) December 31, 2017–January 3, 2018.
6. **Kumar V**, Sinha SK, Agarwal AK. *Self-lubrication of epoxy composite coatings on D2 steel*. Proceedings of the International Conference on Sustainable Energy and Environmental Challenges (SEEC–2017), CIAB, Mohali (India) February 26–28, 2017.
7. **Kumar V**, Sinha SK, and Agarwal AK. *Tribological studies of epoxy and its composites coated on steel in dry and lubricated conditions for green tribology*. International Tribology Conference (ITC), Tokyo (Japan), September 16–20, 2015.
8. **Kumar V**, Sinha SK, and Agarwal AK. *Tribology of epoxy graphene coating on steel substrate in dry and lubricated condition*. ASIATRIB International Conference, Agra (India), February 17–20, 2014.
9. **Kumar V**, Sinha SK, and Agarwal AK. *Tribology of epoxy composites (graphene and graphite) coatings on steel in dry and lubricated conditions*. National Tribology Conference (NTC–2014), Bangalore, December 15–17, 2014.

Posters Presented

1. **Kumar V**, Sinha SK, Agarwal AK. *An Alternative Lubrication for Automotive Engines*. Proceedings of the International Conference on Sustainable Energy and Environmental Challenges (III-SEEC), IIT Roorkee, December 18-21, 2018.

2. **Kumar V**, Sinha SK, Agarwal AK, Solanki VK. *Epoxy composite coatings for engine applications*. Proceedings of the International Conference on Sustainable Energy and Environmental Challenges (SEEC–2017), Bangalore (India) December 31, 2017–January 3, 2018.
3. **Kumar V**, Sinha SK, Agarwal AK. *Epoxy composite coatings for extreme condition application*. Proceedings of the International Conference on Sustainable Energy and Environmental Challenges (SEEC–2017), Mohali (India), February 26–28, 2017.
4. **Kumar V**, Sinha SK, Agarwal AK. *Effect of nano-filler in epoxy*. Nano India 2017 IIT Delhi (India), March 15–16, 2017.

BOOK

Editor

1. **Kumar V**, Agarwal AK, Jena A, Upadhyay RK. *Advances in Engine Tribology*. Springer, Singapore. Series ISBN 978-981-16-8336-7.
2. Katiyar JK, Bhattacharya S, Patel VK, **Kumar V**. *Automotive Tribology*. Springer, Singapore. ISBN 978-981-15-0433-4, Oct. 2019.

Contributed Chapters

1. **Kumar V**, Agarwal AK. *Friction, Wear, and Lubrication Studies of Alcohol-Fuelled Engines*. Advances in Engine Tribology 2021; 9-29. Springer, Singapore. ISBN 978-981-16-8336-7.
2. **Kumar V**, Agarwal AK, Jena A, Upadhyay RK. *Introduction to Advances in Engine Tribology*. Advances in Engine Tribology 2021; 3-7. Springer, Singapore. ISBN 978-981-16-8336-7.
3. **Kumar V**, Agarwal AK. *Material Compatibility, Technical Challenges, and Modifications Required for DME Adaptation in Compression Ignition Engines*. Alternative Fuels and Advanced Combustion Techniques as Sustainable Solutions for Internal Combustion Engines 2020; 37-57, Springer, Singapore. ISBN978-981-16-1513-9.
4. Pal M, **Kumar V**, Ankur Kalwar, Mukherjee NK, Agarwal AK. *Prospects of Fuel Injection System for Di-Methyl Ether Applications in Compression Ignition Engines*. Alternative Fuels and Advanced Combustion Techniques as Sustainable Solutions for Internal Combustion Engines 2020; 11-36, Springer, Singapore. ISBN978-981-16-1513-9.
5. **Kumar V**, Agarwal AK. *Material Compatibility Aspects and Development of Methanol-Fuelled Engines*. Advanced Combustion Techniques and Engine Technologies for the Automotive Sector 2020; 37-51, Springer, Singapore. ISBN 978-981-15-0368-9.
6. **Kumar V**, Agarwal AK. *Tribological Aspects of Automotive Engines*. Automotive Tribology 2019; 17-29, Springer, Singapore. ISBN 978-981-15-0433-4.
7. Katiyar JK, Bhattacharya S, Patel VK, **Kumar V**. *Introduction of Automotive Tribology*. Automotive Tribology 2019; 3-13, Springer, Singapore. ISBN 978-981-15-0433-4.
8. **Kumar V**, Sinha SK, Agarwal AK. *Tribological Studies of an Internal Combustion Engine*. Advanced Engine Diagnostics 2019; 237-253, Springer, Singapore. ISBN 978-981-13-3275-3.
9. Singh AP, Sharma N, Satsangi DP, **Kumar V**, Agarwal AK. *Reactivity-Controlled Compression Ignition Combustion Using Alcohols*. Advanced Engine Diagnostics 2019; 9-28, Springer, Singapore. ISBN 978981133275-3.

AWARDS

- Senior Research Associateship, CSIR 'Pool Scientist' (2018 to 2021)
- Best Ph.D. thesis award (2018), International Society for Energy, Environmental and Sustainability
- Best paper oral presentation award, International Conference on Sustainable Energy and Environmental Challenges (SEEC-2017)
- Institute Fellowship travel grant award for Japan Visit (2015)
- Qualified GATE (2008, 2011, 2012)

MEMBERSHIP

- Life Member of the International Society for Energy, Environment and Sustainability (ISEES).

Organizational Activities

- Organizing Team Member in IV-SEEC, NEERI Nagpur, India.
- Organizing Team Member in III-SEEC, IIT Roorkee, India.
- Organizing Team Member in SEEC-2018, IISC Bangalore, India.
- Organizing Team Member in SEEC-2017, Mohali, India.
- Evaluation Committee in TOSC-2016, IIT Kanpur, India.
- Member Counselling Service 2013-2014 IIT Kanpur, India.
- Mess Committee Member 2013 IIT Kanpur, India.
- AME Secretary-2013-2014, IIT Kanpur, India.

Workshop and Courses Attended

- Short-term training program on Design of engine for emission compliance, (17-21 April 2019), IIT Kanpur, India.
- Short-term training program on Advanced Course on Engine Combustion, Diagnostics, Emissions Control, and Emerging Fuels, (3-7 August 2018), IIT Kanpur, India.
- GIAN course on Fundamental of Micromachining, (17-21 August 2017), IIT Kanpur, India.
- Summer School Tribology, (24-28 Jun 2013), IIPM, Gurgaon, India.
- International Workshop on Renewable Energy for Sustainable Development, MANIT Bhopal, India.
- Seminar on Alternatives of Clean Energy and Nuclear Safety, RGPV Bhopal, India.
- Course on Vehicle Familiarization, TATA MOTORS Pune, India.

REFERENCES:

1. Prof. Avinash Kumar Agarwal, Professor, Department of Mechanical Engineering, Indian Institute of Technology (IIT) Kanpur, 208016, UP, India. Email: akag@iitk.ac.in, Phone Number: 05122597982
2. Prof. Sujeet Kumar Sinha, Professor, Department of Mechanical Engineering, Indian Institute of Technology (IIT) Delhi, 110016, India. Email: sks@mech.iitd.ac.in, Phone Number: 01126591123

Place: IIT Kanpur
Date: 01-10-2022

Vikram Kumar