

Organization of “TRIBOINDIA – 2018” Conference 13th – 15th December 2018 (VJTI – Mumbai)

“TRIBOINDIA – 2018” Conference was organized by the Department of Mechanical Engineering, Veermata Jeejabai Technological Institute (VJTI), Mumbai under the aegis of Tribology Society of India, during 13-15 December 2018. The theme of the Conference was “Tribology for Reliability and Life”. Following are some of the highlights of the event.

Pre-conference Workshop: A preconference workshop was organized on 12th December 2018 with Dr. Michel Fillon, France and Mr.S.K. Kamble, RCF as the main speakers.

Inaugural Event: TRIBOINDIA - 2018 was inaugurated by Dr Michel Fillon, (Institute Pprime, CNRS – Universite de Poitiers, France).



Dignitaries on dais during the release of Technical Book of Abstract in the inaugural function
(L to R) Dr VM Phalle, Prof Satish V Kailas, Prof Dhiren R Patel, Dr Michel Fillon, Mr SS Mantha,
Mr Ajay Kumar Harinarain, Dr S A Mastud

Participation: The conference had more than 120 registered delegates. A group photo taken during the event is shown below:



Sitting Row (L to R) Dr/Ms/Mr/ Prof/ : V M Phalle, Har Prasad, A K Mehta, Michel Fillon, Dhiren R Patel, S S Mantha, Satish V Kailash, Umesh Doshi

Standing Row 1: Sangram Patil, Nandu Durge, Atulkumar S. Patil, Vilas K. Patil, Ajay Kumar Harinarain, .. Kamal Mukherji, Prof. Mani Kant Verma, P Mahato

Standing Row 2: Sooraj S Rawat, Ankitendran, Hemant M Bari, Jaya Singh, Prof. R. Thomas, Shilpa Bhambure, Mrunal Kshirsagar, Basavraj, .. M. J. Pawar

Standing Row 3: Sumit Karegaonkar, K N Yadav, Vaibhav Kalhapure, Shreyas Jain, Dinesh Verma, T. Nagaraju, Sangeeta Bansode, Prashant Kushare, B. D. Bachchhav, N. V. Borse, Rahul B Meshram,

Standing Row 4: Arun Sharma, Dhuldev Kokare, .. Homendra, Ajay Gandrade, Anvesh K. Virkunwar, Vinayak Shinde, Abhishek Khairnar, Mangesh Saraf, B.S. Kothawale, Steffen Bots, ... Suvendu Mohanty, ... Rajkumar B Patil, Sunil Katkar, Pranab Samanta, Digvijay Mhamane, Shubrajit Bhaumik, ... Pawan Kumar, .. Jitendra K Katiyar

- **Plenary Sessions:** There were 9 eminent speakers who addressed the participants during the plenary sessions spread over 3 days of the conference. These included Prof. Satish Kailas (IISc. Bangalore), Dr. Harish Hirani (CMERI Durgapur), Dr. Har Prashad (Ex-BHEL), Prof. P.K. Limaye (BARC), Dr. N.K. Hada (DRDO), Dr. Michel Fillon, France and T. Nagaraju (PES College of Engg., Mandya, Karnataka).
- **Technical Sessions:** The technical sessions during the conference were arranged in the following 10 broad areas, in which 100 papers were presented:
 - a) Tribology of Bearings: Total Presented Papers - 16
 - b) Lubricants and Additives: Total Presented Papers – 27
 - c) Wear: Total Presented Papers - 17
 - d) Tribology: Total Presented Papers - 11
 - e) Materials: Total Presented Papers - 15
 - f) Surface Coatings: Total Presented Papers - 05
 - g) Tribo Testing: Total Presented Papers - 06
 - h) Condition Monitoring: Total Presented Papers - 06
 - i) General Engineering: Total Presented Papers - 06
 - j) Bio Tribology: Total Presented Papers - 05

Sponsorship: Following were the esteemed Sponsors for TRIBOINDIA -2018:

- Diamond Sponsor : IndianOil
- Gold Sponsors : BPCL, DRDO, SERB
- Silver Sponsors : SBI, BRNS, Shivajirao S Jondhale College of Engineering
- Others : Several Organizations, such as Ace Instruments, GE India, AICTE, DUCOM, AIMIL Ltd., Balmer Lawrie, Luvserv, and Triangle, joined hands for successful completion of the conference.

Musical Night: The conference participants were entertained through a gala musical night by Mrs. Sunita Ajay Gangrade, Faculty of Indian Classical Music at Somaiya School of Music -Vidyavihar, Mumbai, on the first day of the conference. The program was appreciated by all participants, delegates, faculty, staff and students of VJTI.

Concluding Session: TRIBOINDIA 2018 ended with the concluding session organized on the last day of the conference. During the concluding session highlights of the three days of the technical program were presented by Dr V M Phalle, the Organizing Secretary of the event.

The awards of the best papers were given by the Chief Guest, Dr Dhiren R Patel. Dr T Singh, Joint Secretary (TSI) presented the vote of thanks.



Concluding Session: Seated (L to R) Dr V M Phalle, Dr T Singh, Prof Dhiren R Patel, Dr Michel Fillon and Dr Har Prashad

- **Awards:** Awards for the best papers among different categories were presented by Tribology Society of India. Following are the award winners:
- **TSI 1st Best Paper in Applied Research Category:** Combined Effect of Graphite and PTFE Nanoparticles as Oil additives on the Tribological Performance (TI-122) by **Mr Vinay Saini**, Jayashree Bijwe, Sarita Seth & SSV Ramakumar.
- **TSI 2nd Best Paper in Applied Research Category:** Plasma Spray Deposition of Aluminium Oxide on Stainless Steel Substrate for Wear Resistance Applications (TI-098) by **Ms Vandana Mishra**, Y. Chakravarthy, Neelima Khare, K. Singh, and P.K. Limaye.
- **TSI 1st Best Paper in Academic Research Category:** Nanoscratch Property of Self-lubricating Ti/MoS₂ Nanocoating at Nano-scale Level (TI-129) by **Ms Summera Banday**, M.F.Wani, M.Junaid Mir, Jagtar Singh, Shuhaib Mushtaq, M.Jebran Khan, S. Shahid Saleem.
- **TSI 2nd Best Paper in Academic Research Category:** Evaluation of Tribological Behavior of Paraffin Oil based Lithium Greases with Graphene Oxide and Reduced Graphene Oxide Nano Sheet as an additive (TI-167) by **Mr Sooraj Singh Rawat**, A. P. Harsha, O. P. Khatri.

For more details of the TRIBOINDIA 2018 please view the TSI Conference Archive at the link <http://tribologyindia.org/archive-for-tribology-conferences.htm>

TSI Executive Committee for the Term 2019-2020

The election of TSI Executive Committee was held on 13th December 2018 on the first day of the TRIBOINDIA – 2018 Conference at VJTI - Mumbai. Mr. Ajay Gangrade, Member - TSI kindly agreed to be the Returning Officer for the election. The election results were declared in the TSI General Body Meeting held in the evening of 13th December 2018 at the same venue. The list of members in the new Executive Committee are given below.

Sl. No.	Name	TSI Position	Organisation
1	Dr S S V Ramakumar	President	Indian Oil Corporation Ltd. R&D Centre, Faridabad
2	Prof Satish V Kailas	Vice President	IISc Bangalore
3	Dr Barun Chakrabarti	Vice President	L&T Hydrocarbon Engineering Limited, Mumbai
4	Mr Ajay Kumar Harinarain	Secretary	Indian Oil Corporation Ltd. R&D Centre, Faridabad
5	Dr Pankaj Bhatnagar	Joint Secretary	Indian Oil Corporation Ltd. R&D Centre, Faridabad
6	Dr Tarunendr Singh	Joint Secretary	Bharat Petroleum Corporation Limited, R&D CENTRE, Mumbai
7	Mr Rajendra Mahapatra	Treasurer	Indian Oil Corporation Ltd. R&D Centre, Faridabad
8	Mr Kamal Mukherjee	Executive Member	Formerly of Coal India Ltd., Chhattisgarh
9	Prof Satish Sharma	Executive Member	IIT Roorkee, Uttarakhand
10	Prof C S Ramesh	Executive Member	Alliance University - Bangalore
11	Dr. Ram Turaga	Executive Member	IISc Bangalore
12	Prof Mayank Tiwari	Executive Member	IIT Patna
13	Dr Deepak Saxena	Executive Member	Indian Oil Corporation Ltd. R&D Centre Faridabad
14	Dr Sudhir Rashingkar	Executive Member	RCG Instruments (India) Pvt. Ltd., Pune
15	Mr D Sothi Selvam	Executive Member	Balmer Lawrie & Co Ltd, Kolkata
16	Mr. S. R. Durugkar	Executive Member	L&T Hydrocarbon Engineering Limited, Mumbai
17	Mr Kushal Banerjee	Executive Member	Hindustan Petroleum Corporation Ltd., Mumbai
18	Prof A P Harsha	Executive Member	IIT BHU, Varanasi
19	Prof Jayshree Bijwe	Executive Member	ITMMEC - IIT Delhi,
20	Mr P Pathak	Executive Member	SAIL R&D Centre for Iron and Steel (RDCIS), Ranchi
21	Dr. Vikas M. Phalle	Executive Member	VJTI Mumbai

A Round-up of Tribology Events

Technical lecture at Bhilai Steel Plant

Dr Har Prashad, Past Vice President TSI and recipient of "TSI Life Time Achievement Award", delivered a technical talk on "Fault Diagnosis and Bearing Failure Analysis- Case Studies" to the plant engineers and managers at Bhilai Steel Plant. The talk was much appreciated by the team.



Dr Har Prashad delivering the talk to Bhilai Steel Plant Engineers



Dr Har Prashad being felicitated by BSP team for his valuable talk

Tribology related technical programs By Mr Hemant M Bari

Mr Hemant M Bari, DGM (MTP Dept.), Condition Monitoring Cell, Adani Electricity Mumbai Limited Mumbai (AEML) and Member (TSI) has been conducting technical programmes on tribology related issues. Details of some of his recent programmes are given below:

- 2-day workshop on Condition Monitoring & Fault Diagnosis was organized by Mechanical Engineering Department at K.K. Wagh College of Engineering, Nasik (28-29 December 2018)



Condition Monitoring Workshop covering Basics & Analysis was conducted at UP Board Thermal Power Plant, Paricha, Jhansi (24 -26 July 2018)

Some of the other programmes conducted by Mr. Bari include:

- Invited talk on Vibration Spectrum Analysis during the 3-Day Course on Research & Development in Condition Monitoring of Rotating Machine, at IIT Indore (10 December 2018)
- Condition Monitoring Workshop with Basics, Analysis & Hands-on Practice for Vibration Measurement at Amrutvahini College of Engineering, Sangamner (15-16 September 2018)
- Invited Talk on Basics of Vibration for Mechanical Engineering Students at Zeal College of Engineering, Pune (27 March 2018)
- Condition Monitoring Workshop with Basics, Analysis & Hands-on Practice for Vibration Measurement at University of Petroleum & Energy Studies (UPES) Dehradun (15-16 March 2018)
- Invited Talk at 2-Day Short Term Course on Condition Monitoring of Mechanical and Electrical Systems using Advanced Signal Processing Techniques at IIT Indore (11 March 2018)

Organization of IndiaTrib-2019 during 1st – 4th December 2019

Department of Mechanical Engineering Indian Institute of Science (IISc), Bangalore

IndiaTrib-2019, the flagship event of TSI, will be organized by Department of Mechanical Engineering of Indian Institute of Science (IISc), Bangalore during 1st – 4th December 2019. This will be the tenth mega event in the series of international conferences, which are being organized by Tribology Society of India since the year 1997. Earlier known as the International Conference on Industrial Tribology (ICIT), the International Edition of TSI Conferences has now been rechristened as IndiaTrib.

IndiaTrib-2019 will have active participation of a galaxy of eminent Tribology experts from India and abroad. A series of technical sessions will showcase the latest work being done in Tribology research and applications. The Conference will feature a technical exhibition and Business Meet sessions to promote industry – Academia linkage. A cultural event will highlight the rich artistic traditions of India.

Complete details of IndiaTrib-2019 can be viewed on TSI website at <http://tribologyindia.org/>



TSI invites all Members to whole-heartedly participate in this event and make it a grand success.

Young Research Scholars in Tribology

Name of Research Scholar: Ajay Kumar Gangrade

Title of Ph.D. Thesis: Performance Analysis of a Hydro-dynamically Lubricated Conical Journal Bearing

Supervisor: Dr. Vikas M. Phalle, VJTI - Mumbai

Co- Supervisor: Dr. S. S. Mantha, VJTI - Mumbai



Brief Abstract of Thesis:

Hydrodynamic journal bearing is the most widely used bearing to support rotating machines. Generally radial and axial loads are generated in many turbo-machines and for sustaining such loads normally journal and thrust bearings are employed. These bearings are expensive and occupy space. Thus, the need arises to explore the suitability of conical hydrodynamic journal bearing for supporting the radial load, with provision to resist the effect of axial load. Therefore, the conical hydrodynamic journal bearing is suggested as a good, compact replacement option for two separate bearings. In this research work, analytical method, experimental work and CFD analysis have been used to investigate the performance of conical hydrodynamic journal bearing for Newtonian fluid, operating in isothermal and aligned conditions.

The parametric study has been presented for various configuration of conical hydrodynamic journal bearing in terms of semi cone angle, aspect ratio, eccentricity ratio, radial load and journal operating speed. A customized experimental set-up of conical hydrodynamic journal bearing (CHJB) is prepared for experimental work at VJTI, Mumbai and numerically simulated results have been validated on this test-rig. Finite element method is used to solve the modified Reynolds equation in the spherical co-ordinate system for conical hydrodynamic journal bearing. The analysis basically comprises the modified Reynolds equation and its formulations, fluid-film thickness equation and required boundary conditions. The dimensionless performance analysis has been performed for various aspect ratios, semi cone angles, eccentricity ratio, variable external applied load and wide range of journal operating speeds.

Results have been computed in terms of performance parameters, such as axial and radial load capacity, minimum film thickness, stiffness and damping coefficients, etc. The analysis also focuses on the stability of rigid rotor-bearing system to determine the threshold rotor speed. The results from this study are useful at preliminary design stage for academic interest and provide an insight in application of compact conical journal bearing for combined radial and axial load in practice. The aim of this study is to find suitability of conical hydrodynamic journal bearing for sustaining the radial

Name of Research Scholar: Akant Kumar Singh

Title of Ph.D. Thesis: Investigations on Fiber Augmented Functionally Graded Material Based Polymer Spur Gears (2018)

Supervisor: Dr. Siddhartha, Assistant Professor, Department of Mechanical Engineering, National Institute of Technology Hamirpur, Himachal Pradesh - 177005



Brief Abstract of Thesis:

The research towards functionally graded materials (FGMs) with polymers matrix is now a well-established area of research, with significant contributions from various researchers. However, the research with a motive to manufacture actual mechanical components capable of being used in real life applications in this field has not advanced much, owing to manufacturing limitations. When it comes to the functional performance within a component, FGMs seem to be an attractive alternative. This functional requirement is very vast and varied, like high thermal resistance at outer surface of the component, high corrosion resistance, electrically conductive outer surface, high toughness at inner core of the component and high wear resistance at the outer exposed surface. Gears are such components where the concept of gradation can be effectively exploited as we strive for high wear resistance on the surface of gear tooth. Therefore, actual challenge lies in developing a manufacturing route to produce such gears, in order to exhibit characteristics that are not achievable by traditional methods of gear manufacturing. It would be a fair idea to couple

centrifugation technique with injection molding to achieve this objective. This research work is principally focused on development of a novel manufacturing technique for producing FGM based polymer gears with high wear resistance, for low load applications and investigations pertaining to the service life of such gears. The primary focus of this work revolves around thermal and wear performance of homogeneous and FGM gears, but this work is further reinforced by investigating noise emission and transmission efficiency of homogeneous and FGM gears.

Three well known polymers, Polypropylene (PP), Polybutylene Terephthalate (PBT) and Polyamide 66 (PA66) are selected as matrix material for gear manufacturing. Glass fiber is used as reinforcing material. Amongst three gear materials taken in this research work, 30 wt% PA66 based FGM gears prove to be the most wear resistant for stipulated runs. Under identical experimental parameters, the service life of PA66 based gear was also found to be the best amongst the lot. The transmission efficiency of fiber filled PA66 gears was found to be the best amongst all combination used in this experimental work. The mathematical model developed in this work is inspired by well-known Archard's wear theory of sliding wear, and consequently, a specific wear rate equation is developed for estimation of wear of gear for specified service life. A series of experiments are conducted on FGM based gears and their homogeneous counterparts under various test conditions. To execute this, an experimental schema is developed following design of experiments approach using Taguchi's orthogonal array, with an intent to lessen the number of experiments without forfeiting the information to be extracted. The analytical and experimental investigations and SEM micrograph confirm that, during centrifugation, fibers tend to move towards outer periphery, thereby making the manufactured gears more wear resistant. Any research work can never be termed as complete until its findings are presented on a single canvas. To present a complete panorama of this work, the calculation of ranking order is done by using VIKOR (ViseKriterijuska Optimizacija I Komoromisno Resenje) method for all combinations of glass fiber reinforced PP, PBT and PA66 based homogeneous composites and FGMs collectively, as ultimately the same materials are used for gear manufacturing as well. The theoretical findings and experimental observations seem to be in good harmony with predictive model as well, which is mandatory for any research work.

Name of Research Scholar: Pradeep Kumar G S

Title of Ph.D. Thesis: Development and Characterization of Al6061 Based In-situ Composites

Supervisor: Dr. R Keshavamurthy, Professor & Head, Department of Mechanical Engineering, Dayananda Sagar College of Engineering, Bengaluru - 560 078



Brief Abstract of Thesis:

The present investigation focuses on synthesis and characterization of Aluminum 6061 based metal matrix composites by incorporating varied percentage of TiC and TiB₂ reinforcements via in-situ reaction. Developed in-situ composites have been subjected to hot forging at a temperature of 500°C. The synthesized composites have been characterized at each processing interval (Cast and Forging) to record variation in terms of microstructure, mechanical, tribological and corrosion properties of the in-situ composites. Further, both cast and forged alloy and its in-situ composites have been subjected to solutionizing at a temperature of 550°C followed by quenching and ageing (natural and artificial) and their effects on mechanical, tribological and corrosion properties have been studied. Further, SEM studies on fractured surfaces, worn surfaces and wear debris were carried out. X-ray diffraction analysis, X-ray photoelectron spectroscopy and energy dispersion X-ray analysis of worn surfaces of both as cast and hot forged in-situ composites have been conducted. Microstructures of the composites have revealed a fairly uniform distribution of in-situ formed TiB₂ and TiC particles. Density and porosity of composites increase with the increased content of reinforcement in both as cast and hot forged conditions. Ductility of the composites

decreases with increased content of reinforcement in the matrix alloy for TiC and TiB₂ system under both cast and forged conditions. The coefficient of friction of cast and hot forged composites decreases with increased contents of reinforcement. Corrosion studies have revealed that both as cast and forged composites exhibited marginal inferior corrosion resistance in 3.5% NaCl solution when compared with the matrix alloy. In all the cases studied, Al6061-TiC in-situ composite system exhibited improved mechanical, tribological and corrosion properties when compared with Al6061-TiB₂ in-situ composite.

Name of research scholar: Naveena B. E.

Title of Ph.D Thesis: Development and Characterization of Plasma Sprayed Flyash Based Composite Coatings

Supervisor: Dr. R. Keshavamurthy, Professor & Head, Dept. of Mechanical Engineering, Dayananda Sagar College of Engineering, Bengaluru-560078



The present research focuses on development and characterization of plasma sprayed flyash-Al₂O₃ and flyash-SiC composite coatings on Al6061 substrate. Typically, Al alloys are favored as promising engineering material for various applications, owing to their lower weight, high strength, ease of manufacture, excellent structural rigidity and suitability for elevated temperature application. On the other hand, it has relatively poor surface properties compared to other structural materials. However, the widespread application of Al alloys has been greatly limited in engineering field, where wear, erosion, corrosion and combined erosion-corrosion resistance are significant. But, this deficiency can be overcome by adopting suitable coating technique, like thermally sprayed atmospheric plasma spraying technique (APS).

APS is one of the most effective practices to protect the Al alloys against surface degradation by developing a relatively thick, dense and hard metal/ceramic coating. As the spray grade powders are costly, the applications of APS are getting restricted. To address this problem, this research has been carried out to minimize the cost of spray material and find the possibility of using low-grade substitute feedstock materials, like industrial wastes (Flyash class-F) and relatively inexpensive ceramics (Al₂O₃, SiC) as composite coating materials. Taguchi's L27 DoE method is adopted to optimize the spray process parameters based on response characteristics (micro hardness, porosity and bond strength) of developed composite coatings, in order to develop eminent coatings. It is observed that flyash-Al₂O₃ coatings show a considerable improvement in bond strength, porosity and hardness when compared with flyash-SiC coated specimen. Further, the developed coatings under optimum process parameters are evaluated to compare the adhesive wear, slurry erosive wear and corrosion characteristics. Also using statistical approach, the influence of various operating variables/factors on the slurry erosive wear and dry sliding wear were evaluated and analyzed.

It is found that flyash-Al₂O₃ coatings have shown a superior resistance to sliding wear by 7.7-fold and flyash-SiC coated specimen also shown marginal increase of 3.2-fold when compared with uncoated substrate. The slurry erosive wear behaviors of developed coatings of flyash-Al₂O₃ offer a 77 % better resistance to slurry wear and combination of flyash-SiC coatings exhibit a 35 % improvement in slurry wear resistance when compared to uncoated Al6061 alloys. Further, the developed coatings were subjected to corrosion tests (Polarization studies, Salt spray and Immersion corrosion test). Results revealed that the developed flyash-SiC coatings exhibited high levels of corrosion resistance when compared with flyash-Al₂O₃ coated Al6061 alloy for a given test duration.

**In Focus: Tribology and Surface Interaction Research Laboratory,
Department of Mechanical Engineering, SRM Institute of Science and
Technology (SRMIST), Kattankulathur, Chennai-603203
(<http://mysrm.srmuniv.ac.in/TSIRL>)**

Since the establishment of SRM, the Department of Mechanical Engineering remains among the premier departments of SRMIST. It has had a long and illustrious history and offers courses at the graduate, postgraduate and doctorate levels. The Tribology Lab was established in 2013 and by 2017 the lab developed significantly, with own website and more facilities. The department is actively working towards enhancing research in Tribology. In June 2018, Dr. Jitendra Kumar Katiyar along with Mr. Shubrajit Bhaumik and T V V L N Rao organized a 6-Day Workshop on Tribology of Materials and Manufacturing. In this program expert lectures were delivered by eminent speakers from IISc, IITs, NITs and government agencies. This program was very successful, with 35 participants from various academic institutes, as well as research scholars and industry professionals. The major areas of focus for research in the field of Tribology are as follows: Fluid film bearings, Polymer Composite, Cutting Fluids, Automotive Brakes, Surface Texturing, Surface Coating and Metal Matrix Composites. Resources available in Tribology and Surface Interaction Research Lab for Testing and Characterization are: Dry and lubricated pin-on-disc tribometer, four ball test rig, gear test rig, Micro weighing machine and ultrasonic homogenizer.



Dry Pin-on Disc Tribometer

The normal load can be varied from 5 N to 100 N. The pin diameter, pin length and wear track radius can be varied from 8 mm to 10 mm, 30 mm to 30 mm and 50 mm to 100 mm, respectively.



Lubricated Pin-on-disc Tribometer

The normal load can be varied from 10 N to 200 N. The pin diameter, pin length and wear track radius can be varied from 8 mm to 10 mm, 30 mm to 40 mm and 50 mm to 145 mm, respectively.



Four Ball Tribometer

The normal load can be varied from 60 N to 8000 N. The ball diameter is 12.7 mm. Extreme pressure and anti-wear properties can also be determined by this equipment.



Gear test rig

This gear test rig design is based on the AGMA Tribology test report by W.A Bradley. The gear and pinion teeth are 30 and 20 in number, and the pitch circle diameters are 108 mm and 72 mm, respectively.

New Members of Tribology Society of India (August 2018 - January 2019)

Sl. No.	LM #	Name	Affiliation
1	S-5881	Mr Mainak Saha	IIT Madras, Chennai
2	5882	Mr Prasad Dattatraya Kulkarni	Sinhgad Institute of Technology, Mumbai
3	S-5883	Mr Abhishek Chaudhary	NIT Kurukshetra
4	5884	Mr Soumya Sikdar	Presidency University, Bangalore
5	5885	Dr Praveen A. S.	Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai
6	5886	Dr Anita Mohan	IIT BHU, Varanasi
7	5887	Mr Kingsuk Maity	HPCL Mumbai
8	5888	Dr S. Ramesh	KCG College of Technology Chennai
9	5889	Mr G. Saravana Kumar	Vickram College of Engineering, Enathi Tamilnadu
10	S-5890	Mr Ankitendran	IIT BHU Varanasi

We extend our hearty welcome to the new Members and look forward to their active contribution in TSI activities.

❖ All Members are invited to send their publication materials, suggestions and feedback to Mr. A. K. Mehta, ED (TSI) at the email ID: office.tsi@tribologyindia.org

❖ Compiled by Mr. A. K. Mehta, ED (TSI) and Edited by Dr. Barun Chakrabarti, Vice President (TSI), on behalf of Tribology Society of India. This publication is for free circulation among TSI Members.

www.tribologyindia.org