



# TSI Newsletter



A Quarterly Newsletter from Tribology Society of India

TSI Salutes Motherland in the 50th year of its Independence.

## HIGHLIGHTS OF GENERAL BODY MEETING OF TRIBOLOGY SOCIETY OF INDIA

The General Body Meeting of TSI was held on December 4, 1997 at Hotel Oberoi Grand, Calcutta, during ICIT '1997. The highlights of the proceedings of the meeting are as follows:

- I. Duly audited statement of accounts presented by **Dr.K.K.Chaturvedi, Treasure, TSI** was approved by General Body.
- II. **Secretary's report** for the progress of TSI during the years 1995-97 was presented. In the report, number of life and other members have been reported to increase from 147 to 446 during 1995-97. The commendable efforts for the activity of TSI News Letter taken up by BHEL, Corporate R&D division was highly appreciated. In this tenure, 9 executive committee meetings were held from time to time to finalize various TSI issues including ICIT '97. Other highlights of the report was the creation of TSI local chapters at Bhopal, Mumbai and Dehra Dun and planning of local chapters at Delhi and Trichy, and the decision of the TSI award committee to title the award as **Tribology Society of India-Distinguished Tribology Award**. Also, Secretary announced that the ICIT '99 will be organized by BHEL, Corporate R&D division at Hyderabad. It was brought to the notice of General Body that the pending issues concerning TSI Journal, Lubrication Series books, Members Directory etc., will be taken up by New Executive Committee during 1998-99.
- III. **Prof.D.V. Singh**, President TSI, in his speech has emphasized the tribology momentum in India after the tribology moment initiated in 1972. And for strengthening this momentum, he has put forward the Think-Tank concept by forming the forward looking group for nucleating idea in the area of Tribology besides other innovative steps to move ahead TSI activities.

## HIGHLIGHTS OF THE 25<sup>TH</sup> EXECUTIVE COMMITTEE MEETING OF TSI

The 25th Executive Committee Meeting of TSI was held on February 12, 1998 at AICTE, New Delhi. The meeting presided by **Prof.D.V. Singh, President, TSI**. The meeting was attended by Dr.J. Bhatia (Vice-President), Shri A.K. Mehta (Secretary), Shri V.N. Sharma (Treasurer) and five executive committee members: Shri Sudhir Singhal, Dr.A.S.Sarma, Shri G.S. Ravi, Prof. Kshitij Gupta and Shri Mukesh Gupta. The following were discussed and decided

### 1. Additional Nominations on the Executive Committee in line with the Constitution.

It was decided that **Dr.Har Prashad**, Member, TSI Executive Committee, be elected to the position of Joint Secretary of TSI. In addition, **Dr.P. Jagannathan**, G.M., B.H.E.L., Corporate R&D division, be offered a membership of TSI E.C. for the period of 1998-99. Both of them have accepted the offer.

### 2. Action Plan of the TSI Activities for the year 1998-99.

a) **TSI Journal** : It was decided to form a **TSI Journal - Committee** comprising **Dr.D.V. Singh, Dr.J. Bhatia, Dr.Kshitij Gupta, Shri G.S. Ravi, Shri S. Singhal and Dr.B.K. Gupta**. This committee will look into all aspects related to earlier options and consider new options to bring out TSI Journal. **Dr.D.V.Singh**, President TSI will be the convenor for this.

b) **TSI constitution** : It was decided to have a one man Constitution Committee

consisting of **Shri V.N.Sharma** to look into and finalize the draft of the revised constitution of TSI. Shri A.K.Mehta, Secretary, TSI will furnish all relevant documents and suggestions received in this regard to Shri V.N.Sharma.

c) **TSI Finance Committee** : It was agreed to have a **Standing Finance Committee** with Shri V.N.Sharma, Treasurer as the convenor along with Shri G.S.Ravi and Shri Mukesh Gupta as members. Secretary, TSI will furnish the current financial update to this committee.

d) **TSI Lubrication Series books** : **Shri Sudhir Singhal** would be the one man committee to look into all aspects of the publication etc., under the TSI Lubrication Series.

Apart from the above E.C. has decided to drop financial support from TSI for attending overseas conferences. The issues concerning transfer of NCIT funds from IIT, Mumbai will be kept alive. And, updated list of TSI members will be sent to all E.C.members by the Secretary.

### 3. ICIT '99 to be organized by BHEL, Corporate R & D Division at Hyderabad.

It was decided that all future biennial conferences be organized under the aegis of TSI, as International ones henceforth. A view was expressed that ICIT 2001 may be hosted in Mumbai and organized/coordinated by TSI, Mumbai chapter.



Prof.Dr.Ing.Wilfried J.Bartz of Technische Akademie Esslingen, Germany delivering plenary lecture on **Lubricants and the Environment** in ICIT '97 on 5th December 1997.



Dr. Amol Kumar Jha

## Congrats

**Dr. Amol Kumar Jha**, Scientist, Regional Research Laboratory, Bhopal has received Material Research Society of India (MRSI) Medal Award - 1998 for his distinguished research and development work in the areas of Metallurgy and Materials Sciences.

MRSI, a Founding Adhering Body of the International Union of Materials Research Societies (IUMRS) and an apex interdisciplinary scientific body promotes and recognizes excellent R&D works on material.

**Dr. Jha** was presented the MRSI medal, a certificate of excellence and a cash prize at the 9th Annual General Meeting of the Society held at IIT, Chennai during 11-13 February 1998 by Prof. S.K.Joshi, President of the Society.

TSI News Letter congratulates Dr.A.K.Jha on this achievement.



## ABSTRACTS OF SOME OF THE LATEST SIGNIFICANT PUBLICATIONS BY THE TSI MEMBERS IN THE REPUTED JOURNALS

### A New Test Rig for Oil Evaluation in Textile Spindles

Published in Journal of Lubrication Engineering, Volume 53, No.7, July 1997, pp 19-25. Authored by **A.K. Mehta, A.V. Suresh Babu, V. Martin, R.T. Mookken, S.P. Shrivastava and A.K. Bhatnagar**, Indian Oil Corporation Ltd., R and D Centre, Faridabad-121007.

#### Abstract :

This paper describes the development of Textile Spindle Oil Test Rig (TESTER) for the measurement of frictional force in high speed textile spindles used in a modern textile spinning mill. The test rig uses an actual bolster of a textile spindle supported on an air bearing and a one-eighth inch steel ball. An improvised air turbine runs the spindle at about 15000 rpm. The resulting friction in the test set up with test oils is measured with the help of a high precision load cell. **To the best of the authors' knowledge, no such rig has been cited anywhere in the literature.**

**The TESTER has been used successfully to study the effect of viscosity and different types of friction modifiers on the tribological behaviour of lubricants for this application.** The laboratory screening of energy efficient textile spindle oils using the TESTER showed a good correlation with field trials where three-to-six percent energy savings was observed.

The paper briefly describes the TESTER and correlation obtained between laboratory tests using it and the actual field trial in a textile spinning mill.

### Diagnosis of Failure of Rolling - Element Bearings of Alternators - A study

Published in Journal of Wear, Vol. 198, 1996 pp 46-51. Authored by **Har Prashad**, B.H.E.L., Corporate R and D Division, Hyderabad.

#### Abstract :

**The paper deals with the causes of failure of rolling-element bearings used in alternators and establishes the reasons as to why the bearings used in a particular design of alternators fail prematurely.** The voltage across the bearings leading to the passage of electric current and the development of magnetic flux density on the bearing elements, which cause premature failure of the rolling-elements bearings of the alternators, are experimentally determined.

The development of stray voltage and excessive magnetic flux density are established in the particular design of alternators where the bearings are located under the stator field coil and a.c. coils, as against those designs where the bearings are housed at a suitable location so as to avoid the effect of excited magnetic flux by the field and a.c. coils. **The findings reported in the paper give overall guidelines to designers to avoid the premature failure of bearings.**

### Wear Characteristics of a Hardfaced Steel in Slurry

Published in Journal of Wear, Vol.209, 1997, pp 255-262. Authored by **R.Das Gupta, B.K.Prasad, A.K.Jha, O.P.Modi, S.Das, A.H.Yegneswaran**, RRL, Bhopal.

#### Abstract :

This study discusses some observations made during the wear testing of hardfaced layers deposited on a low carbon steel. Two kinds of (wear resistant) hardfacing materials were (separately) overlaid on a steel substrate and characterized for their microstructural features and wear behaviour. Conditions of wear testing were varied in terms of the content of sand particles in the slurry, the speed of rotation of the specimens and the distance traversed. The substrate material was also subjected to identical tests in order to assess the effects of hardfacing / overlaying. **Hardfacing of the steel substrate resulted in a significant improvement in the wear resistance (inverse of wear rate) over that of the substrate, irrespective of the test conditions.** Speed of rotation had a mixed influence on the wear rate wherein the intermediate speed caused maximum wear loss. The distance traversed had a mixed influence on the wear rate of the specimens in the sense that in some cases wear rate decreased with distance while a reverse trend was noted in the remaining situations, whereas under one test condition, the wear rate first decreased with distance, attained a minimum and then again tended to increase. Moreover, the larger sand content in the slurry led to lower wear rates. The wear behaviour of the specimens has been explained on the basis of the predominating material removal mechanisms, such as erosion and abrasion, in different situations. These have been further substantiated through their wear surface and sub-surface characteristics.

## TRIBOLOGY - ITS UNFORESEEN AND UNRECOGNIZED SIGNIFICANCE

**Dr. Har Prashad**

Tribology, the science and technology of interacting surfaces in relative motion and practices related thereto, play a major role in evolving optimum maintenance strategies. It is a Techno-economical tool for maintainability, reliability, energy saving and safety. It also serves the medical science. The Jost Report of 1966 estimated that 4 billion Pounds could be saved by the British industry and \$ 1.6 billion by the Australian industry by improved application of tribology. **Even with such a huge estimated saving, the significance of Tribology in industry in general is unrecognized and is not foreseen.** This needs to be analyzed and reviewed.

### MAINTAINABILITY

Maintainability is an ability of an item, under stated conditions of use, to be retained in, or restored to, a state in which it can perform its required function, when maintenance is performed using prescribed procedures and resources.

Self-lubricating and life long lubricated machine elements are now quite common which do not need maintenance, but general awareness of their advantages is limited. **Furthermore, selection of lubricants tends to be carried out in most cases in a rather arbitrary fashion and yet original equipment manufacturers having specified a lubricant are sometimes quite assertive that no other lubricant should be used.** There is a need to give complete technical characteristics of the selected lubricant by the equipment manufacturers to enable operators of plants and equipment to confidently work out lubricant specifications with the help of tribologist. The field of tribology is so ubiquitous that every industrial organization should have tribologists to tackle various technical problems of maintainability, lubricant selection and other related issues for smooth running of plants and equipment.

The role of a tribologist may be unrecognized, unforeseen but it can not be ignored. In industry, lubricant change or replenishment intervals may be interpreted as improved maintainability. In general, a few lubricants provide better service as lubricants by corrosion

prevention, contaminant removal, cooling, etc. Still, the criteria for lubricant drain intervals is normally governed by factors other than the ability to lubricate, such as contamination by dust, soot, fuel and coolant. **The best method and optimum solution of determining lubricant replacement intervals is by on-line condition monitoring or by a sampling oil or wear debris analysis program developed by the science of tribology.** This is a significant area where the importance of tribology, considering techno-economical benefits, can not be challenged.

### RELIABILITY AND ENERGY SAVING

Reliability is the measure of the ability of a product to function successfully in the specific environment for the required period. For example,  $L_{10}$  life of a rolling-element bearing means that 90% of bearings will achieve a life of one million revolutions when operated under prescribed conditions. Failure and reliability are composite and their sum is equal to unity. This means that if an item has not failed, then it has succeeded. One of the major contributors to failure is improper design despite the large data available on the design of tribological components. It may be that the components are so designed that effective lubrication is not possible during operation. In such cases, design could be improved if the lubricant is perceived as a design element at the design stage. Such an approach will undoubtedly increase the expected life of the machine and increase its reliability. This has an implicit relevance of Tribology even in the design stage of various elements of machinery.

**Fire, the most significant discovery of the stone age is the earliest manifestation of one of the principles of Tribology.** Even today, flame is created by match sticks and conventional lighters with flint stone on the same tribological principle. **As a counterpoint to the general belief that the wheel is one of the greatest invention of man, one could argue that the bearing on lubricated axle of the wheel, is even a greater invention.** Hitherto unrecognized efforts of tribology need to be reviewed which have gone into development of bearings and lubricants in comparison to



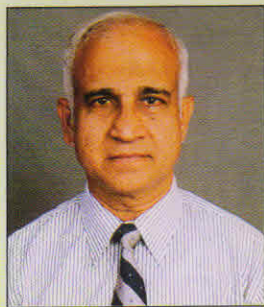
## MEET OUR EMINENT TRIBOLOGISTS

**Dr.B.S.Prabhu** currently a Professor at I.I.T., Chennai has been engaged in teaching and research in the areas of mechanics, tribology, rotor dynamics and condition monitoring for the last 30 years. He has been

rated as an excellent teacher. He is one of the very few experts in the area of tribology and rotor dynamics in the country.

**His contributions in the area of fluid film bearings and rotor dynamics are well recognized nationally and internationally.** He has been invited to participate and present papers in a number of

International and National Conferences such as IFTOMM Congress, ASME/STLE Tribology Conferences, ASME Turbo Expo, National Conference on Tribology. He is one of the editors of Plant Engineering and Management published by Tata McGraw Hill in 1995. He has prepared five continuing education modules for working professionals in industry in the areas of lubrication, tribology, vibration analysis, condition monitoring and failure analysis under MHRD/ISTE Continuing Education Project. **He has published over 150 papers in the areas of his research work. He visited Germany twice under DAAD fellowship to**



**Dr. B.S. Prabhu**

**conduct research at the Technical University of Karlsruhe and Canada under International Scientific Exchange Award of NSERC, Canada at the Concordia University,**

**Montreal.** He has guided 14 Ph.D., 6 M.S. and over 50 M.Tech., students. He is a member of American Society of Mechanical Engineers (USA), Society of Tribologists and Lubrication Engineers (USA), Life Member of : Tribology Society of India, Indian Institution of Plant Engineers, Association of Machines and Mechanisms. He has organized various National Conferences. He is

a viewer for many international journals such as Applied Mechanics Reviews, Wear, Tribology International, Journal of Sound and Vibration, Journal of Tribology (ASME) and STLE Transactions. He is a member of many committees and working groups set up by IIT Chennai, DST, ARDB, DRDO and NAL.

He has been involved in a large number of sponsored and consultancy projects for DST, MHRD, AICTE, DRDO, NIOT, BHEL, LPSC (ISRO) and various other organizations on tribology testing, analysis, rotor stability, condition monitoring etc.

**Dr.A.K.Bhatnagar** took his Ph.D., in Chemistry in 1967 from Lucknow University. **He worked as Post Doctoral Fellow at Massachusetts Institute of Technology (MIT), University of Wincosin and at Robert Robinson Laboratories at**

**Liverpool.** Dr.Bhatnagar worked as Dy.Director, Indian Institute of Chemical Technology, Hyderabad and as General Manager (R&D) at Hindustan Insecticides Limited before joining Indian Oil Corporation R&D Centre, Faridabad in 1985.

**Presently as Executive Director, he is heading the R&D Centre of Indian Oil Corporation Limited, Faridabad.**

Dr.Bhatnagar has used his expertise and experience for developing lubricants, greases, fuel and lube additives. **The invention of Titanium Complex Grease has been recognized as best invention of the year 1996 and has bagged 4 prestigious national awards.** Recently, he has been elected President of Indian Chapter

of National Lubricating Grease Institute (NLGI) USA. He is also interested in value addition projects in the refining area.

Dr.Bhatnagar is member of Scientific Advisory Committees and Research Councils of various national laboratories. He is active member of various scientific societies and founder Secretary of Indian Society of Analytical Scientists - Delhi Chapter.

**He has 42 national and international patents,** a good number of which are

commercialized or are under commercialization. **He has authored more than 100 publications in various reputed national and international journals.**

**TSI News Letter congratulates Dr.Bhatnagar for his commendable achievements and Tribology Society of India is proud for his close association with TSI activities and his encouragement to the TSI members.**



**Dr. A.K. Bhatnagar**

### (Contd from 2)

wheels. Undoubtedly, the axle and bearing, a tribological device, allow the wheel to move uninterruptedly and has revolutionized the technological development. But, the significant contribution of tribology in this aspect is still considered as secondary as compared to that of the wheel.

For reliable design of plain bearing, a tribologist foresees and predicts that too high an eccentricity ratio will lead to insufficient lubricant film thickness and excessive wear, causing failure by overheating, whereas, too low a value causes problems of instability. This causes the journal center to orbit around the bearing centre resulting in vibration and lead to bearing failure prematurely.

Tribology is a science of energy saving. Around 40% of the world's energy production is consumed in overcoming friction and due to losses in wear. In 500 MW Turbo sets, friction losses could be up to 5 MW. 20 to 30% oil is lost through poor quality of seals. **Tribological advances have reduced the coefficient of friction from 0.3 to 0.02 by advancement of material, design, lubrication, maintainability and has increased the reliability of operation with an enhanced energy saving.**

### SAFETY

Frictional heating is a common cause of accidents, either directly by seizure of components or indirectly by causing fires. **Failure diagnosis, in general reveals that the role of tribology is neglected in safety of plant/industry.** During asperity contact, the compressive stresses in the materials rapidly reach a stage where plastic flow takes place. With further increment of normal load, or introduction of a tangential stress, the actual contact increases. The understanding of friction under varying conditions of stress, surface microgeometry and surface films is very complex and worthy of further investigation/study being an unprobed area of tribology.

### ROLE IN MEDICAL SCIENCE

The science of tribology has made a significant dent in medical science by development of lubricating fluid similar to that of synovial fluid having identical rheological characteristics, development of endoprostheses replacements, and design of artificial heart valve for continuous operation for 40 million cycles per annum for many years.

### CONCLUSIONS

The direct savings by application of tribology to maintenance engineering have not made

enough impact despite the large saving predicted by the Jost Report. There has been little reference made to tribology in various fields in the last two decades in this regard. **It may be because the tribologists have not embraced the wider philosophy of terotechnology i.e., the science of the combination of management, finance and engineering.** However, through the implicit and significant role of tribology, many unforeseen failures are prevented by tribological principles. **From the broad analysis and review, it may be predicted that the efforts of tribology in maintainability, reliability, energy saving, safety and service to humanity will not remain unrecognized and unforeseen in future in engineering and medical sciences.**

### MINUTES OF THE FIRST MEETING OF TRIBOLOGY SOCIETY OF INDIA (TSI) (MUMBAI REGIONAL CHAPTER)

A meeting of TSI members from the Greater Bombay area was convened on 21st November 1997. The main agenda for the meeting was formation of the Bombay Regional Chapter for TSI. 16 members attended the meeting and following decisions were taken :

1. Following Committee Members were unanimously elected for the Greater Bombay Regional Chapter :

- i) Prof.M.C.Dwivedi (IIT Mumbai), Regional President.
- ii) Dr.G.Vasudev (Bharat Petroleum), Regional Secretary.
- iii) Ms.Kamla Maheshwari (BLF Bombay), Regional Treasurer.

And the executive committee members as :

- i) Shri S.R.Mehta (Motul Mafatlal).
- ii) Shri S.Srivastav (APAR Bombay).
- iii) Dr.R.G.Jadhav (Houghton Hardcastle).
- iv) Shri S.Chiranjeevulu (Lubrizol).

2. IIT Mumbai would operate as the headquarters for the Mumbai Regional Chapter and Prof.Dwivedi will ensure that all infrastructural facilities are provided by IIT Mumbai for holding meetings and other activities of the Chapter at the venue.
3. Members from the user industries to be encouraged to become members of TSI.
4. Regional Chapter to organize a training programme in lubricants as one of its initial activities.



## CONFERENCE CALENDER - PLAN TO ATTEND

1998

**September 16-18 :** INSYCONT '98 Energy and Environmental Aspects of Tribology, KARKOW, POLAND.

**Contact Address:** Prof. S. Pytko, Akademia Gornicza Hunicza, Al. Mickiewicza 30, 30-059, KRAKOW, POLAND. Fax +48 12 33 9103; Tel +48 12 173065; email : S.Pytko@uci.agh.edu.pl

**October 12-15 :** ASIATIB '98 - The First Asia International Conference on Tribology, Beijing, China.

**Contact Address:** Professor Chen Darong, State Key Laboratory of Tribology, Tsinghua University, Beijing 100084 P.R.China, Tel : +86 (10) 62782064; Fax : +86 (10) 62784691

**October 25-29 :** ASME/STLE International Conference and Exposition, Toronto, Ontario, Canada.

**Contact address:** Brian Bigalke, ASME, 345 E. 47th Street, 7th floor, New York NY 10017 U.S.A., Tel : 212.705.7057; Fax : 212.705.7856; email : bigalkeb@asme.org

1999

**January 21-23 :** 11th LAWSPSP Symposium, Mumbai.

**April 25-29 :** International Conference on Wear of Materials, Georgia, U.S.A.

**May 23-27 :** STLE Annual Meeting. Ballys, Los Vegas, Nevada

**October :** ASME/STLE Tribology Conference. Hilton Head, South Carolina.

**December 1-4 :** ICIT '99, Hyderabad, India.

2000

**May 7-11 :** STLE Annual Meeting. Opryland Hotel, Nashville, Tennessee.

2001

**May 20-24 :** STLE Annual Meeting. Buena Vista Palace, Kissimmee, Florida.



A section of the audience at the Technical Session **Strategy for wear control** on the concluding session of ICIT '97

## 11<sup>TH</sup> LAW PSP SYMPOSIUM

LAWPSP (Lubricants-Additives-Waxes and Petroleum Speciality Products) Symposium is being organized from January 21 to 23, 1999 at IIT, Mumbai to review the current status and future projection of petroleum based industry. **This provides an independent forum for experts from industry, R & D and Govt. organizations to share experiences in an academic environment.**

For further details, please contact :

**Prof. M.C. Dwivedi**

Department of Chemical Engineering, Indian Institute of Technology (IIT)  
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## INTERNATIONAL CONFERENCE ON INDUSTRIAL TRIBOLOGY 1999



BHEL, Corporate R and D Division, Hyderabad under the aegis of Tribology Society of India is proud to announce the **International Conference on Industrial Tribology to be held at Hyderabad, India from 1st to 4th of December 1999.**

The second International Conference on Industrial Tribology of the Century in India is being organized with the theme of **Tribology by 2000 and Beyond**, to bring to focus the achievements of Tribology by 2000 and the future advancement of this discipline in the 21st Century.

Engineers, Scientists, Academicians and Practitioners in Tribology are invited to present papers in line with the theme of the conference. Prospective contributors are requested to forward 3 copies of the abstracts of about 300 words in double spacing by July 31, 1998 to the Organizing Secretary.

For further information, please contact :

**Dr. Har Prashad**

Organizing Secretary

International Conference on Industrial Tribology

C/o Bharat Heavy Electricals Limited

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## INTERNATIONAL CONFERENCE ON WEAR OF MATERIALS

The 12th **International Conference on Wear of Materials will take place in Atlanta, Georgia, USA on 25-29 April 1999.**

This conference is devoted to the understanding and control of all forms of wear of materials, and closely related topics. The objective is to provide a forum in which the results of current research and engineering studies can be presented and discussed in order to promote interaction amongst researchers and practicing engineers. The scope of Wear of Materials 99 will include papers in any of the following areas : wear mechanisms in closed tribosystems, open systems and lubricated systems; wear of materials combinations under various service conditions; understanding and control of friction & friction-induced vibration; conceptual and engineering modelling of wear and friction mechanisms; wear of industrial equipment and products; surface engineering, materials selection and design for wear resistance; wear testing/simulation and surface characterization related to wear.

For full information, contact :

**Amy Richardson**

Email : a.richardson@elsevier.co.uk or

Fax : +44 (0) 1865 843958 at the conference secretariat or

Visit the conference website on <http://www.elsevier.nl/locate/wom99>

## LET'S THINK IT OVER

Very seldom does man realize that his health, success and wisdom depend in great part on the issue of the battle between his good and bad habits. He who would establish within himself the rule of the soul, must not allow the bodily kingdom to be occupied by bad habits. All such evils must be banished by training diverse good habits in the art of victorious psychological warfare.

**Whisper from Eternity**

**To our readers :** TSI Members are requested to send short technical communications for Publication in TSI Newsletter to the Editor.