

FOR RESTRICTED CIRCULATION

TSl Newsletter

A PUBLICATION OF TRIBOLOGY SOCIETY OF INDIA

NUMBER : 2 and 3

(Reg. No. 1391)

DECEMBER 1990

ABOUT TRIBOLOGY SOCIETY OF INDIA

Tribologists in India have been organizing Conferences on this subject since 1972 for exchange of ideas and interaction. Such Conferences have been organized in 1972, 74, 76, 79, 81, 84, 86 and 89 by Industries, Research Institutions and Academic Institutes. During the Conference held in 1984, participating delegates decided to form a Professional Society to cater to the needs of this discipline. The legal procedures were initiated and formal registration was completed in 1989. Permission has also been obtained from the Govt. of Andhra Pradesh/Govt. of India to change name of the Society to "Tribology Society of India", as requested by the Society. The Society has been affiliated to the International Tribology Council, U.K.

Presently, scientists and engineers working in oil industry, power sector, research laboratories, academic institutes and government agencies are its members. The number of institutional members, donor members, ordinary members and student members is 8, 11, 145, and 10 respectively. The Society has started publication of a quarterly newsletter beginning January '90 from the Indian Institute of Petroleum, Dehra Dun. The next National Conference on Industrial Tribology is all set to be held in February, 1991, at Bangalore and will be hosted by CMTI, Bangalore. The Head Office of the Society is at Bharat Heavy Electricals Limited, Corporate Research and Development Division, Tribology Laboratory, Vikasnagar, Hyderabad-500593. The Office Bearers of the Executive Committee are as follows :

1. President : Shri Indu Vira, General Manager
Indian Oil Corporation
G-9, Ali Yavar Jung Marg
Bandra/East, Bombay-400 051.
2. Vice-President : Prof. A. Sethuramiah
ITMMEC, IIT
Hauz Khas, New Delhi-110 016.
3. Secretary : Shri K. Kurian John, AGM (Mechanical)
BHEL Corporate R & D
Vikasnagar, Hyderabad-500 593.
4. Joint Secretary : Dr B. Kanaka Raju, Head, IBT, CGI
VSSC, Trivandrum-695 022.
5. Treasurer : Shri T. Muralidhara Rao
BHEL Corporate R & D
Vikasnagar, Hyderabad-500 593.

This NEWS LETTER is being brought out by the staff of the Tribology Laboratory of Indian Institute of Petroleum on behalf of the Tribology Society of India.

ANNUAL G.B. MEETING

The General Body meeting was held on 8-12-89 at I.I.P. where 39 members participated. The meeting was presided over by Shri Indu Vira, President of T.S.I. The Secretary, Shri K.K. John summarized the budget for the year 1989-90 and gave details of the receipts and expenditure. Thereafter, budget for the year 1990-91 was presented and approved by the General Body. The following points were discussed.

- * Central Machine Tool Institute, Bangalore agreed to sponsor the NCIT '91.
- * The change of name of Society to T.S.I.
- * The first Newsletter was brought out by I.I.P. on behalf of T.S.I. and distributed amongst its members.
- * A Workshop on 'Energy Efficient Oils' was held on 8-12-89.
- * Shri K. Radhakrishna was appointed as the Auditor of the Society for the year 1989-90 and 1990-91.
- * General Body expressed its thanks to the Indian Institute of Petroleum for organising the Workshop and for publishing the Newsletter.

EXECUTIVE COMMITTEE MEETING

Shri Indu Vira, President, T.S.I. presided over the meeting on 8-12-89 in presence of Shri K.K. John, Shri S. Singhal, Dr. A. Sethuramiah and Prof. D.V. Singh. The following points were discussed :

- * Need to represent a member of the Society in International Conference atleast once a year.
- * A brief write up about the activities of T.S.I., its background, Newsletter, Workshop etc., is to be sent to the International Tribological Societies.
- * To develop a methodology for the formation of local chapters, region-wise and subject-wise. An approach paper is to be prepared by Shri Indu Vira and Shri R.A. Rao.
- * Possibility of participation of foreign experts in the National Conference.
- * It was decided that a suitable membership card be designed for issue.
- * It was felt desirable to take Tribology to rural areas. An approach paper may be prepared by Shri R.A. Rao and Shri K. Kurian John.
- * The next NCIT meeting will be held in Feb. 1991 at Bangalore. Suggestions came up for publication of 2-3 selected papers from the proceedings in international journals. For this purpose, a committee is to be formed.
- * It was decided that attempts should be made to host an International Conference during 1992-93.

WORKSHOP ON 'ENERGY EFFICIENT LUBRICANTS'

A Workshop on 'Energy Efficient Lubricants' was organised by the Indian Institute of Petroleum on behalf of T.S.I. on 8-12-89 at I.I.P. Campus. The workshop was attended by 21 delegates from various organisations and also by other members of the Society.

The Workshop was divided into two sessions. In the first, a key paper entitled 'Energy Efficient Lubricants' was presented by Shri V. Martin of IOC (R & D) under the chairmanship of Prof. D.V. Singh, formerly of University of Roorkee. The paper dealt with the role of 'FMs' in energy saving, their interaction in relation to automotive and industrial oils. At the end, Prof. Singh summarized the total proceedings of the session.

In the second session chaired by Prof. A. Sethuramiah, I.I.T., Delhi; Dr. G.C. Joshi and Dr. G.C. Misra of I.I.P. presented a chemist's view-point of 'FMs' while Shri S. Bhattacharya and Shri M. Gupta of I.I.P. presented an engineer's view-point of possible energy saving sources. The following trends emerged from the Workshop :

- * Need for developing a methodology for evaluation of 'FMs.'
- * Need for studying the mechanism of 'FMs.'
- * Possibility of using synthetic lubricants and their development in the country.

The deliberations of the Workshop were released to the press. Mr. S. Singhal, Actg. Director, I.I.P. stated that upto 7% energy saving was possible in automotive vehicles with the use of 'FMs' and some of these gains were already helping the country in saving of fuel and energy worth crores of rupees annually.

THIRD EXECUTIVE COMMITTEE MEETING

The following was the outcome of the meeting held on 24-5-90 :

- * The name of Society as 'Industrial Tribology Society' has been changed to 'Tribology Society of India'.
- * The Society instituted two prizes for the best paper in basic research and applied research. The cash prize would be Rs. 500/- each alongwith a certificate.
- * It was informed to all that the Silver Jubilee of International Tribology Council, U.K., was taking place on 9-3-91.

HONORARY MEMBERSHIP

The General Body was pleased to confer Dr. I.B. Gulati, retd. Director, I.I.P., a honorary membership for his excellent technical contribution and effort for the cause of the Society.

INSTITUTIONAL MEMBERS

The following organisations have become Institutional members of the Society :

1. M/s. Centraline Lubro-Tech. Engineers P. Ltd.
Post Box 11712, Nariman Point, Bombay-400021
2. M/s. I.B.P. Co. Ltd.
3, Graham Road, Budge 24 Parganas, West Bengal
3. M/s. Balmer Lawrie & Co. Ltd.
5, J.N. Heredia Marg, Ballard Estate, Bombay-400038
4. M/s. Indian Oil Corporation Ltd.
G-9, Ali Yavar Jang Marg, Bandra (East), Bombay-400051
5. M/s. Tide Water Oil Co. (India) Ltd.
32, R. Kamani Marg, Ballard Estate, Bombay-400038

6. M/s. Bharat Petroleum Corp. Ltd.
A. Installation, Sewree Fort Road, Sewree (East), Bombay-400015
7. M/s. Petrosil Oil Co. Ltd.
Apee Jay House, 3 Dinsha Vatcha Road, Bombay-400020.
8. M/s. Centre for High Technology
707, N. Delhi House, 27, Barakhamba Road, New Delhi-110001
9. M/s. Hindustan Petroleum Corp. Ltd.
8, S.V. Marg, P.B. No. 155, Bombay-400038
10. M/s. Lubrizol India Ltd., Leo House, 4th Floor
88-C, Old Prabhadevi Road, Bombay-400025

DONOR MEMBERS

1. Shri Indu Vira, G.M. (SA), Indian Oil Corporation
G-9, Ali Yavar Jung Road, Bombay-400051 Ph. 6424215
2. Shri Krishna Lall Awasthy, I.T.M.M.E.C., I.I.T.
Hauz Khas, New Delhi-110016
3. Prof. A. Sethuramaih, I.T.M.M.E.C., I.I.T.
Hauz Khas, New Delhi-110016, Ph. 650358
4. Shri Sudhir Singhal, Actg. Director
Indian Institute of Petroleum, Dehra Dun-248005, Ph. 24508,
5. Shri K. Kurian John, Dy. G.M., BHEL (Corporate Research & Development
Division), Vikas Nagar, Hyderabad-500593, Ph. 261065
6. Dr. B. Kanaka Raju, Head IBTS, ISL
Vikram Sarabhai Space Centre, Trivandrum-695022, Ph. 562498/563817
7. Prof. B.V.A. Rao
I.I.T., Madras-600036, Ph. 415265/415923
8. Shri R.A. Rao, Indian Additives Ltd.
480, Anna Salai, Nandanam, Madras-600035
9. Shri J.R. Nanda, Chief Research Manager
IOC, R & D Centre, Sector 13, Faridabad-121007, Ph. 8127256
10. Shri Prem Sagar Gupta, ONGC, OBG
Chandkhara, Ahmedabad-380054
11. Ashok Kumar Agarwal, ONGC Nagar
C-30, Palavasna, Mehsana-384001

ORGANISATIONS ENGAGED IN TRIBOLOGY

Industrial Tribology, Machine Dynamics and Maintenance Engineering Centre (I.T.M.M.E.C.) : Institute No. 2.

The Centre was set up in 1978 under the aegis of the Indian Institute of Technology, Delhi with the aim to bridge the technological gap between industries and I.I.T. I.T.M.M.E.C. has established itself as a forerunner of technology in the areas of Maintenance, Machine Dynamics and Industrial Tribology.

The Centre offers the services in the form of research, sponsored and consultancy projects, special purpose training programmes—both in-house and in-plant, Workshops and Conferences. Based on a Total System Approach to solve the problems faced by the Industries in relation to the achievement of capacity utilisation of their plants, the Centre has been involved in over 96 consultancy and research projects for the various sectors of the Industries. Additionally, it has also conducted 35 training programmes in which over 900 engineers from various sectors have been trained.

The Centre is equipped with SRV Optimal tester, Four ball, Pin and disc, Friction and wear testers, Twin Station Journal testing machines, Ion-plating system etc. Excellent support is provided by Scanning Electron Microscope with EDAX, Micro hardness tester, Ferrograph, Particle Size Analyser and Surface roughness measuring equipment.

Differential Scanning Calorimeter, GC, Mass Spectrometer, UV Spectrometer, Differential Thermal and Thermal Gravimetric Analysers etc. are some of other important facilities at the Centre to augment the tribological studies.

Current thrust areas are : studies related to lubricants, lubrication, friction and wear studies, wear control, condition monitoring techniques, RAM engineering, failure analysis, vibration and noise engineering and performance evaluation.

CORRIGENDUM

The brief views on 'Need for Aqueous Oil System in India' published in the issue of December 1989, TSI Newsletter was written by Mr. V.K. Jain, IIP instead of Dr. D.S. Shukla.

CALENDAR

- 9th National Conference on Industrial Tribology (Feb. 1991, Bangalore).
- Frontiers In Tribology (15-17 April. 91 Stratford Upon Avon, UK).
- STLE 1991 Annual Meeting (29 April.-2 May 91 Montreal, Canada).
- 2nd Argentinian Conf. on Tribology (12-16 Aug. 1991, Buenos Aires, Argentina).
- STLE/ASME Tribology Conf. (14-16 Oct. 91, St. Louis, MO, USA).

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TECHNICAL BRIEF

The need for applications of new coating technologies and treatments for tribological applications : A challenge of the 90's for the Indian Industry. —Dr. P.C. Nautiyal

In the last decade, a number of new technologies have emerged world wide for the modification of surface properties that offer considerable flexibility and process economies for tribological control. They rely on the deposition of a wide range of soft and hard compounds as well as metals. The real advantage offered by these new technologies is that they allow close control of coating thickness and composition not available in most standard treatments. They permit combinations of coatings, for example, a soft overlay on a hard coat, in such a manner that no further finishing of the tribo-element is necessary. These processes include pyrolytic decomposition, chemical vapour deposition, physical vapour deposition, reactive evaporation, ion plating, sputtering, ion implantation etc.

Friction and wear problems are severe in metal working as high unit normal loads and boundary lubrication are encountered. Tribo-chemical and tribomechanical reactions are restricted to the surface, and therefore, better tool performance can be achieved if it is converted or a surface layer is deposited to provide the requisite hardness and temperature resistance. This is dictated by considerations such as good bond-

ing, absence of harmful residual stresses, and matched thermal expansion. Coated carbide cutting tools have been in use now for about 15 years and they are very well accepted for industrial metal cutting operation. It is estimated that more than 40% of carbide cutting tools used in the U.S. are coated and this number will increase to about 60-70% (T.E. Hale, Proc. Tech. Conf., Chicago, Ill., U.S.A., Sep. 1982), the reason being their excellent combination of abrasive wear resistance, high chemical stability, freer chip flow resulting in reduction in required horse power and relative ease of manufacture.

The first measurements of the effect of ion implantation on wear were undertaken by Hartley (Inst. Phys. Ser. 28, 1976, 210) who showed that the wear parameters of a 3% Cr nitriding steel, of a 17% Cr stainless steel and of mild steel were significantly improved by implantation. Since this early work, considerable research in both Great Britain (Dearnaley, Thin Solid Films, 54, 1978, 215) and the U.S.A. (Hirrovén, J. Vac. Sci. Technol., 15, 1978, 1662) has confirmed that the wear resistance of ferrous materials can be greatly improved by ion implantation. The life of steel tools and dies can be economically increased by factors of 3-10 (Dearnaley, Ion Implantation Metallurgy, American Institute of Metallurgical Engineers, New York, 1980, p1). It is of great importance to the tool/drilling engineers that extended tool life is not the most significant benefit of TiN, TiC treated tools but the fact that higher feed rates can be achieved with greater success which has a direct bearing on the level of productivity and an inverse relationship to the cost of drilling the hole.

If maximum benefits are to be realised for a particular coating/substrate system, it is of fundamental importance that the inter relationship between the coating microstructure and its properties are understood. By reference to work on physical vapour deposited coatings, such interrelationships are explored (D.S. Rickerby and S.J. Bull, 16th Intn. Conf. Metallurgical Coatings, San Diego, Ca., April, 1989) and the importance of the coating microstructure in dictating many of the physical properties of the coating eg. hardness, adhesion, levels of internal stress, composition etc. are highlighted. Mathews and Sandquist (Proc. Intn. Ion. Engg. Congress, ISIDT'83, Kyoto, Japan, Ed. T. Takagi) using a Pin-on-disc wear test have shown that TiN coatings which have a strong (200) orientation are more wear resistant than a corresponding film with a (111) orientation and the same hardness.

A comparative assessment of different type of coatings has been dealt with to some extent by Habig (Trib. Int. April, 1989, Vol 22, No. 2) whereas Quinto and co-workers (J. Vac. Sci. Technol., A6, 1988, 2149; Mat. Sci. and Engg. A 105/106, 1988, 443) have compared the structure/property relationship for CVD and PVD coatings in metal cutting applications as a function of coating process parameters. There is no simple scheme for producing a film with the complete range of desired properties as often these are interrelated and the properties of the film after deposition are a complex function of the film microstructure, the substrate material and geometry and the physics of the deposition process. In general, there is a trade off between important properties and thus these have to be optimised for a given application and lubricant system. A word of caution is that the effects of changing the surface composition can not be considered in isolation but must be dealt with as an integral part of the tribosystem (Schey, J.A., Tribology in Metalworking : Friction, Lubrication and Wear, ASM, Metals Park, O.H., 1983; Nautiyal P.C. and Schey, J.A., Proc. Nat. Conf. Ind. Trib., Trivandrum, India 1989). There is the possibility that a coated surface may interfere with or prevent rather than promote the adsorption/reaction processes necessary for the functioning of boundary and EP additives.

There is some evidence of this scattered in the literature. For example, Sioshansi and Au (Mater. Sci. Eng. 1985, 69, 161-166) found higher friction but reduced wear in lubricated sliding of 4140 and 06 steel against Ti plus C implanted 52100 steel. Gabriel et al (Proc. 4th Eurotrib, Elsevier, London, 1985, Vol. 1) reported that an ion-plated Ti N surface reduced the wear of a non-plated countersurface when a neat mineral oil was used but actually increased wear when an EP agent (Zn DTP) was added to the lubricant. In the work of Tan et al (Proc. 5th Eurotrib, Espoo, Finland, 1989, Vol. 2, 378-83), the scuffing resistance of steel balls increased with a S additive on a CVD TiN coating, yet a P additive was more effective on a bare steel surface. It is, therefore, important to determine which coating properties dictate its behaviour in any application if an appropriate coating for that application is to be produced.

Results from laboratory wear and friction tests can give some indication of the operating mechanisms that might be found in in-service condition and those properties which are important for a particular mechanism/application can be identified. The question is whether the industry is 'ready' to explore the immense potential offered by the Surface Modification Technology for improving tribological performance? The presentation is necessarily brief and fuller details may be found in the literature cited or from the author.

Printed at EBD Printers, 15, Rajpur Road, Dehra Dun, Ph. 23792
for Tribology Society of India, IIP, Dehra Dun-248005



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