

Tribology for Equipment Reliability

ICIT - 2004



Editor
S.K. Swaminathan

**TRIBOLOGY FOR
EQUIPMENT RELIABILITY**

TRIBOLOGY FOR EQUIPMENT RELIABILITY

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S.K. Swaminathan



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FOREWORD

I am very happy that the fourth *International Conference on Industrial Tribology* (ICIT - 04) is being organized by four of the premier organizations of the country viz. Indian Oil Corporation Ltd, Hindustan Petroleum Corporation Ltd, Bharat Petroleum Corporation Ltd & Larsen & Toubro Limited by joining hands at Mumbai from 15th December to 18th December 2004 under the aegis of the Tribology Society of India. This conference also marks one of the firsts for the society in the cooperative trend for organizing this conference. I sincerely hope that this trend continues in the future which would help in improving the scale of activities of the society, thus meeting its objectives.

The previous three international conferences held at Kolkata, Hyderabad and Jamshedpur were tremendous successes in achieving their objectives. I have no doubt that the Mumbai Conference would also achieve its objectives in full measure.

The theme of the conference "*Tribology for Equipment Reliability*" is very apt in the current industry context. The new generation of equipment and plants are very capital intensive and hence the highest level of uptime is required to realize reasonable returns on investment. Globalization of the business has introduced unprecedented competition in the market. Under such circumstances achieving the highest level of equipment reliability has become a business imperative.

Tribology, as understood today, has a substantial effect on the performance of equipment and the cost of maintenance of assets in manufacturing industries. Systematic application of tribology results in improved life of components and machinery. In this perspective, the theme of the conference is well suited for the need of the hour.

I am very happy to learn that about hundred papers that would be presented in the oral as well as poster sessions are of a very high standard and deal with the latest research and application in the area of tribology for overall improvement of equipment reliability.

The Organizing Committee has done some painstaking work in ensuring the success of the conference and I extend my heartfelt thanks to each member of the committee. I am sure the technical deliberations at the conference would be very rewarding to the delegates and the authors as well.

I wish the conference a real grand success.



(C. Mishra)

C. Mishra
President, Tribology Society of India (TSI)

PREFACE

The *Industrial Conference on Industrial Tribology (ICIT)* being organized at Mumbai under the aegis of the Tribology Society of India will be the fourth in a series of international conferences and nine national conferences. The first three international conferences were organized at Kolkata(1997), Hyderabad(1999) and Jamshedpur(2002). This conference also has special significance in the sense that for the first time, four major industrial organizations of the country namely Indian Oil Corporation Limited, Bharat Petroleum Corporation Ltd., Hindustan Petroleum Corporation Ltd., and Larsen & Toubro Limited are joining hands to organize this conference. I hope that this kind of cooperative effort continues in the future which would help in increasing the activities of the society and also increasing awareness of *TRIBOLOGY* amongst industry and researchers alike. The society has been making significant contributions about the awareness on *TRIBOLOGY* amongst members from industry and academic institutions by way of organizing conferences, seminars and publication of the TSI Newsletter and the recently introduced *Indian Journal of Tribology*.

Over the years, tribology has been gaining increased interest and attention in industry to achieve the goal of optimum operational efficiency through savings in energy consumption and improving maintenance practices which lead to improvement of equipment reliability. In order to focus on the latter aspect, which has not been covered significantly in all the previous national and international conferences organized by the Tribology Society of India, it has been decided to focus on this aspect by the selection of the theme "*Tribology for Equipment Reliability*" for this conference.

The conference besides dealing with this main theme will also deal with other aspects of tribology, such as lubricants & additives, condition monitoring & maintenance, friction wear & surface engineering, materials, tribotesting, rotor dynamics, engine tribology and a new session specially devoted to simulation and modelling. More than 80 papers are expected to be presented spread over 17 sessions during the three and a half days conference. The papers included in the proceedings will certainly be of interest to the delegates drawn from a wide cross section of industry like steel, oil & gas, engineering, cement, power generation, chemicals etc as well as from academic institutions and research laboratories from India and abroad.

I sincerely hope that the conference will be able to succeed in its major objective of identifying current knowledge gaps and evolving action plans and find solutions to bridge the gap for the benefit of tribologists of our country and abroad.

I wish the conference all success.

S K Swaminathan

S.K. Swaminathan
Editor

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