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INTRODUCTION

The 41st Leeds-Lyon Symposium on Tribology was held at Leeds Trinity University in Leeds (UK) under the title “*Integrated Tribology*” from Tuesday 2nd September until Friday 5th September 2014.

What constitutes acceptable friction (simple resistance to motion, energy efficiency or energy loss) and acceptable wear (in terms of useful life and reliability) is constantly evolving. This increases the pressure on the science and engineering of tribology to deliver solutions for a growing range of applications. We now strive to examine surfaces and lubricants at a molecular level, using advanced experimental tools and mathematical models, and scale up the observed phenomena and mechanisms to the macroscopic scale of engineering systems. When working at a molecular level the problem becomes truly multidisciplinary with inputs required from engineers, physicists, chemists, biologists, material scientists, mathematicians and computer scientists. So collaboration across a wide range of disciplines and across the various stages of technology development, often termed Technology Readiness Levels, is growing. In the future, tribology must become truly integrated in science and engineering across

- *Length scales*, science from the molecular scale applied to the performance of full scale engineering and biological systems.
- *Scientific disciplines*, incorporating computer science, chemistry, engineering, mathematics, materials science, physics, and biology.
- *Technology Readiness Levels*, from fundamental science to final product development.
- *Industry sectors*, such as automotive, rail, marine, energy, process and healthcare.
- *Product lifecycles*, from design and conception, through effective monitoring, maintenance and life extension, to recycling and final disposal.

A total of 171 delegates from 19 different countries attended the Symposium and provided a truly international and wide ranging perspective on the latest tribology research relevant to this theme. A full list of the delegates and their affiliations is provided towards the end of this Special Issue.



The two keynote papers were deliberately chosen to provide a contrast in approach across length scales. The first was presented by Rob Dwyer-Joyce (University of Sheffield, UK) who described the innovative development and application of piezo-electric ultrasound sensors to investigate lubricated interfaces in real engineering components, such as the piston ring-cylinder wall sliding interface in an engine, under the title “*In-Situ Measurements in Tribology*”. This methodology starts with the

mechanical response of the interface and interrogates within to determine tribology at the micrometre scale. This was followed by Rob Carpick (University of Pennsylvania, USA) who delivered an insightful presentation entitled “Atomic-Scale Processes in Tribology Elucidated by In Situ Approaches”. Here transmission electron microscopy and atomic force microscopy were applied in novel ways to study surface processes at the nanometre scale to elucidate the tribology of an interface at larger scales.



a) Rob Dwyer-Joyce



b) Rob Carpick

Keynote speakers pictured with Duncan Dowson FRS

In addition to the keynote papers, there were 9 plenary and 93 parallel session papers presented. The questions and discussions provoked during the course of the technical sessions have been captured in written form and are presented towards the end of this Special Issue for the papers published herein. In addition to the oral presentations there were 32 posters displayed and presented, encompassing a range of new topics and complementing research presented in the oral sessions.

The “Dowson Prize” is awarded to the best paper and presentation to a registered research student, or someone within 3 years of graduating from a research degree. The prize was first offered in 2008 in honour of the lifetime achievements of Duncan Dowson FRS and to inspire and reward outstanding tribologists in the early stages of their careers. It essentially mirrors the remit of the “Maurice Godet Award” presented when the Symposium is hosted in Lyon. The 2014 “Dowson Prize”, sponsored by John Wiley & Sons (UK) and Shell Global Solutions (UK), was awarded to Arnaud Ruellan from the Université de Lyon (LaMCoS and MATEIS, INSA de Lyon, France) and NTN-SNR (Annecy, France) for his paper “Understanding White Etching Cracks (WEC) in Rolling Element Bearings: Formation Mechanisms and Influential Tribochemical Drivers”.



Arnaud Ruellan receiving the Dowson Prize from Duncan Dowson FRS (*right*) and Ian Taylor of Shell Global Solutions (*left*)

Prizes were also given for the best 3 posters, sponsored by Afton Chemicals (UK), and were awarded as follows

1st prize: Doris Nekesa Khaemba (University of Leeds, UK), “Micro-Raman Studies on MoDTC tribofilms: The Effect of Rinsing Samples and the Size of the Analysed Area”.

2nd prize: Modestino De Feo (Ecole Centrale de Lyon, France), “Oil Ageing Effect in Boundary and Mixed Lubrication”.

3rd prize: Farnaz Motamen Salehi (University of Leeds, UK), “The Effect of Oil Contamination on Wear and Friction in Variable Displacement Vane Pump”.



a) Doris Nekesa Khaemba



b) Modestino De Feo



c) Farnaz Motamen Salehi

Poster Prize winners pictured with Duncan Dowson FRS

Both the Dowson Prize and the Poster Prizes were judged by panels of international experts drawn from the delegates attending the Symposium. We thank them all for the considerable time and effort which they devoted to reading abstracts and papers, studying posters, talking to the candidates and arriving at their final judgements.

The Symposium Reception and Dinner was held at the Headingley Carnegie Stadium in Leeds, a major sporting venue which is home to the Yorkshire County Cricket Club, Leeds Rhinos rugby league team and Leeds Carnegie rugby union team. A jazz band of pupils studying at the Leeds College of Music entertained the delegates throughout the meal. The friendly atmosphere of the Symposium Dinner and the social trip on the Thursday afternoon provided a valuable additional opportunity for delegates to discuss the technical sessions and their future research. The Thursday afternoon excursion visited Temple Newsham House in Leeds, a Tudor-Jacobean mansion with grounds designed by the famous English landscape artist Capability Brown.

The papers from the Symposium have been disseminated as special issues of Tribology International and the Journal of Engineering Tribology. Authors had the freedom to submit their papers through the symposia organisers for consideration for publication in either of the journals. Refereeing of the large number of submitted papers was undertaken according to the usual procedures specified by the publishers of each of the journals and to full, normal international standards for learned society journal publication. This was a significant workload for the journal editorial teams and for the community of referees who provided their expert opinions on the submissions and we offer our sincere thanks to all concerned.

The 42nd Leeds-Lyon Symposium on Tribology will be held in Lyon from 7th to 9th September 2015 under the title “Surfaces and Interfaces: Mysteries at Different Scales”.

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