

# The Tribochemistry Award

Presented to

**Dr. Hugh Alexander Spikes**

In recognition of his outstanding contribution to tribochemistry by The Tribochemistry Technical Committee (Chair: Dr. Keiji Nakayama), Japanese Society of Tribologists (JAST) in September 2019 in “Tribochemistry Hakodate 2019”.



Hugh Alexander Spikes was born in London in October 1945 and grew up in Birmingham in central England. From 1965 to 1968 he read Natural Sciences at the University of Cambridge, with a focus on Chemistry, before joining the Lubrication Laboratory in the Mechanical Engineering Department at Imperial College London in 1968 to study for a PhD under the supervision of Professor Alastair Cameron. He obtained his PhD for research entitled *Physical and Chemical Adsorption in Boundary Lubrication* in 1972 and then worked as a research assistant on the design of helicopter lubricants and other projects before joining the staff of the Mechanical Engineering Department as a Lecturer in 1978. He has continued to teach and to supervise research in Tribology at Imperial College ever since, becoming Reader and joint Head of the Tribology Group in 1992 and Professor and Head of the Group in 1996. In 2011 he retired from the academic staff and was reemployed as a Senior Research Investigator and Emeritus Professor to focus on Tribology research, continuing to serve as Head of the Tribology Group until 2016. Under his guidance the Tribology Group has grown to five full time academic staff and more than 50 current PhD students and postdoctoral research assistants and fellows. Professor Spikes still supervises PhD and postdoctoral research within the Tribology Group at Imperial College

The focus of Professor Spikes' research has been on the molecular origins of the behaviour of lubricants and has spanned all the lubrication regimes from hydrodynamic through to boundary lubrication. Two particular fields of research interest have been the development of new experimental techniques and tribochemistry.

In 1989 Professor Spikes and his team extended the optical interferometry method to measure very thin films, down to about one nanometer. This enabled boundary lubricant films to be studied *in situ* in high pressure contact for the first time and has led to major advances in our

understanding of thin film lubrication. The ultrathin film interferometric test apparatus developed by Professor Spikes is currently in routine use in numerous oil and additive companies and several academic establishments around the world.

Professor Spikes has worked extensively in the study of film-forming lubricant additives and their influence on friction and wear. His work on thin film lubrication has helped resolved the long-standing debate about the thickness of organic friction modifier films and has led to new strategies for the development of fuel-efficient engine oils that are now widely used by the additive industry. His research on ZDDP and other phosphorus-based antiwear additives provided the first definite evidence of the thick film, solid-like nature of the films formed by such additives during rubbing and the consequent origins of their antiwear performance. Recently he highlighted the importance of mechanical stress in controlling the rates of many tribological processes and has demonstrated conclusively that some lubricant additive reactions are driven by shear stress and are thus a manifestation of mechanochemistry.

An important feature of Professor Spikes' research is that much of it, despite being fundamental in nature, has been carried out in collaboration with industry. This is reflected in more than 120 joint publications with collaborators from more than 30 companies. This close industrial connection has also ensures that Professor Spikes research has had strong impact not only within the academic tribology community but also within industry.

Throughout his career Professor Spikes has published more than 300 refereed research papers and has received ten best paper awards, from the Institution of Mechanical Engineers (IMEchE), the American Society of Mechanical Engineers (ASME) and the Society of Tribologists and Lubrication Engineers (STLE). In 2004 he was awarded the International Award from STLE, the Mayo D Hersey Award from ASME and the Tribology Trust Tribology Gold Medal for his research contributions to Tribology. He is a Fellow of the IMechE and of the Royal Academy of Engineering.

Dr. Spikes has contributed to the ITC and WTC satellite forums on Tribochemistry for many years including the very first one in Tokyo 1995.

He is indeed a worthy recipient of the world's highest honor in tribochemistry – The Tribochemistry Award for 2019.