MS Divisional Seminar

Polymer Chains on Surfaces: Hip Joints, Contact Lenses, Car Engines, Wine…

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ABSTRACT

A surface's tribological properties can be modified dramatically by attaching polymer chains. This approach is evident in nature in sliding contacts, such as those in the hip joint and the eye, where dangling glycoprotein or polysaccharide chains are intrinsic to the natural lubrication mechanisms. Such natural systems can be imitated by the use of synthetic polymers, for example polymer-brush-coated hydrogels that can either show cartilage-like tribological properties or resemble the human cornea. A similar principle can be applied to oil-lubricated systems, such as car engines, by the use of brush-forming polymers that spontaneously adsorb from the oil onto steel surfaces, and tannins in wine or tea can be used to deliberately disturb the natural lubrication mechanisms in the mouth, in order to provide pleasant mouthfeel experiences.

ABOUT THE SPEAKER

Professor Nicholas D Spencer was born and educated in the UK, obtaining his academic degrees at the University of Cambridge, where he began his research career as a surface chemist.

Following his PhD, he moved to the University of California, Berkeley, for a postdoctoral fellowship, working on fundamentals of ammonia synthesis. For the next 11 years he worked in the US chemical industry in the areas of catalysis, superconductors and analytical research. It was here, working with the new technique of lateral-force microscopy, that he first encountered tribology.

In 1993 Spencer became Professor of Surface Science and Technology, in the Department of Materials at the ETH Zurich, Switzerland, founding laboratories working in the areas of tribology, biomaterials and surface functionalization. He has served as Head of the ETH Department of Materials and has taught tribology and surface science to many generations of Swiss students, as well as having given invited courses on surface science and tribology worldwide.

Professor Spencer has made a number of outstanding contributions to the field of tribology. He has pioneered the use of polymer brushes for microscopic and macroscopic lubrication in both aqueous and oil-based environments, significantly advancing our understanding of such systems and our ability to apply them in applications ranging from catheters to concrete slurries. Spencer is co-founder of "Tribology Letters"—one of the premier journals in the field, and has been its Editor-in-Chief over the last three decades. He is also co-founder of the Swiss Tribology Association, and the International Nanotribology Forum, under whose auspices he has organised ten workshops on nanotribology in Asia. The author of over 450 journal articles on tribology, surface functionalization, catalysis, biomaterials, and polymers, Spencer has delivered countless invited and keynote lectures at international meetings. He also has five books and 15 patents to his name. In 2018 he was awarded the Tribology Gold Medal.

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