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TRIBOLOGY MATTERS

TriboLOGY touches every aspect of our day to day existence and the wonder of this is that we are completely unaware how central it is to how we function. Take a snapshot of the beginning of a normal working day for example. A typical morning start will involve brushing one's teeth with toothpaste containing mild abrasive (with a toothbrush with an optimized design for brushing efficiency), using a shampoo and conditioner which have been tested for frictional properties on a wide range of hair types, and for those who have the traditional morning fry up – lubricating the pan in advance with cooking oil to provide a boundary layer between the food and the pan and to reduce adhesion and heat transfer. It is clear that tribology plays a major role in our everyday lives. Whether starting out for work by foot, bicycle or car, friction will define whether our shoes or tyres can grip the road surface and whether the brake or clutch will do their job. If it is raining, the speed limit is modified in some countries, testifying to the influence of tribologists in decision making in the transport industries. And this is only the start of the day!

In the power industry where materials are subject to high temperatures, combinations of corrosive gases and/or hard particles can cause a process called erosion-corrosion where the synergy between the mechanical wear process and chemical degradation typically oxidation or sulphidation can lead to high degradation rates of materials. The large number of variables involved and the various possible interactions have led to a very large amount of academic investigation in this area in recent years.

Technologically advanced coatings such as thermal barrier coatings are being continually evaluated for erosion resistance over a range of temperatures, particle concentrations and sizes.

In the oil and gas sectors, drilling in shallow beds requires tools to resist the impact of sand particles in salt water conditions – an example of tribo-corrosion where erosion or abrasion processes interact with corrosion. In some cases, if the tool is coated with a “hard face”, typically a composite reinforced with tungsten carbide reinforcement particles, the action of the salt water can eat away at the interface between the reinforcement and the matrix material. Hence corrosion can enhance the tribological process i.e. make the coating more easy to wear away. By contrast, the ductile oxide which forms at elevated temperatures on steels in dry oxidizing environments in coal gasification environments can

provide some good resistance to particle impacts, proving that corrosion can equally be good and bad in mitigating the effects of tribological processes.

In the renewable energy conversion processes such as tidal energy, knowledge of the effects of tribo-corrosion of rotating parts in sea water will be critical towards increasing energy conversion efficiencies in these environments. Sea water conditions typically contain three per cent salt – Sodium Chloride – and this can cause pitting corrosion of some of the most corrosion resistant steels. This can change the mechanical properties of the materials causing them to be less tribologically efficient and wear away faster.

Hence the truth should be universally acknowledged that tribology and tribo-corrosion are hugely important in everyday life as well as in the important energy conversion industries. The power that can be unleashed by further

M.M. Stack,
Department of Mechanical
Engineering, University of
Strathclyde

understanding of these subjects is limitless – the Jost report published in the UK in the 1960's attempted to quantify the costs that could be saved through further research in this area. At this juncture, approaching the second decade of the new millennium and with the huge interest in all aspects of energy utilisation, it is perhaps now timely to look into how further understanding of these processes can increase energy efficiencies and reduce material costs. And back to everyday life, just to remind you of how important tribology is, as you click on your mouse to shut down your lap top at the end of the working day, think of the frictional properties of that mouse pad..... So tribology does matter not only in the power industries!



Even using a toothbrush involves tribology