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Bryant, MG orcid.org/0000-0003-4442-5169 (2017) Soft tribology: current trends, concepts and techniques. Tribology - Materials, Surfaces and Interfaces, 11 (4). p. 179. ISSN 1751-5831

https://doi.org/10.1080/17515831.2017.1418718

Soft Tribology: Current Trends, Concepts and Techniques

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The origins of friction, wear and adhesion of low moduli or 'soft' materials is gaining much interest in the area of tribology. This is reflected by the vibrant, active and highly dynamic research activities in this field being conducted across the world. The benefits and impacts of application of tribological principles to soft matter has brought measurable impact to many areas of engineering and medicine and continues to do so. The scale and nature of this activity has motivated this special issue in *Tribology - Materials, Surfaces & Interfaces.*

The tribology of low moduli and soft matter materials is a particular challenging area both in terms of research and practical applications. Whilst there are numerous examples of industrial application, from elastomer seals to medical devices, it is often the case that conventional tribological theories of friction, wear and contact mechanics do not hold. The application of tribological principles has also found popularity in understanding oral and tactile sensation, helping to bridge the gap between bulk measurements and consumer sensation. Without a doubt, the area of low-moduli soft matter tribology is complex, truly interdisciplinary and reliant on the application of physical, chemical and biological concepts. However with this comes a research area rich for exploration and exploitation.

It is my pleasure to present to you a collection of papers detailing some of the recent work in the area of 'soft tribology'. A nice combination of review and technical papers are presented. Pitenis et al [1] presents an eloquent critique of some of the underpinning tribological theories and recent research concerning the origins of friction of soft, aqueous low moduli materials. Garcia et al [2] addresses one of the key issues concerning the characterisation of soft matter materials. A novel approach for surface detection during indentation analysis is proposed eliminating the need to identify the surface contact prior to analysis. The use of computational models to predict material response is also presented by de Boer et al [3]. This paper investigates the load bearing capacity of soft poro-elastic systems, highlighting some of the criteria required from poro-elastic systems to impart fluid load bearing as seen in natural cartilage systems. Moore et al [4] presents a contemporary review concerning the lubrication mechanisms of articular cartilage. They also demonstrate how the development of novel tribometry methods has enable new insights into the lubrication mechanisms of natural articular materials. The ability to manipulate the adhesive properties of soft elastomer surfaces is presented by Prieto-López and Williams [5]. A novel approach whereby micro-fluidic features are integrated into the subsurface of an elastomer material is presented and shown to be effective in manipulating adhesion processes at an interface. Finally, Laguna and Sarkar [6] present a review on the application of tribological principles to oral colloidal systems. This paper demonstrates how the application of tribological principles can contribute to the effective engineering of soft-matter systems.

I hope that the work presented will be of interest across the tribology community and will help to address some of the current challenges in this exciting and crucial field.

1 Pitenis, A.A., Urueña, J.M., McGhee, E.O., Hart, S.M., Reale, E.R., Kim, J., Schulze, K.D., Marshall, S.L., Bennett, A.I., Niemi, S.R., Angelini, T.E., Sawyer, W.G. and Dunn, A.C. Challenges and opportunities in soft tribology. *Tribology - Materials, Surfaces & Interfaces*, 2017, 1-7.

2 Garcia, M., Schulze, K.D., O'Bryan, C.S., Bhattacharjee, T., Sawyer, W.G. and Angelini, T.E. Eliminating the surface location from soft matter contact mechanics measurements. *Tribology - Materials, Surfaces & Interfaces*, 2017, 1-6.

3 **de Boer, G., Hewson, R., Bryant, M. and Dowson, D.** An investigation into the contact between soft elastic and poroelastic bodies rotating under load. *Tribology - Materials, Surfaces & Interfaces*, 2017, 1-9.
4 **Moore, A.C., Schrader, J.L., Ulvila, J.J. and Burris, D.L.** A review of methods to study hydration effects on cartilage friction. *Tribology - Materials, Surfaces & Interfaces*, 2017, 1-13.
5 **Prieto-López, L.O. and Williams, J.A.** Switchable liquid mediated soft adhesive contacts. *Tribology - Materials, Surfaces & Interfaces*, 2017.
6 **Laguna, L. and Sarkar, A.** Oral tribology: update on the relevance to study astringency in wines. *Tribology - Materials, Surfaces & Interfaces*, 2017, **11**(2), 116-123.