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## Modeling approaches for tribological applications

The use of computational modelling and simulation offers new understanding of material responses in tribological contacts. Modeling of changes in material due to surface loading, and calculations of stresses and strains help to understand the mechanisms that result in e.g. surface cracking, wear particle formation and wear. The multi-scale modelling of metal matrix composite coating generated using microstructural material model allowed evaluation of stresses, strains occurring under tribological loading. Modeling also enabled the estimations of damage tolerance of the coating, and provided predictions on the effect of microstructural features on wear resistance in abrasive and erosive conditions. Good agreement was found between the tribological experiments and modeling. The simulation results showed that the microstructural modelling is a practical tool for the digital materials design of wear resistant materials. Modeling can also be applied to generate digital twins of tribological tests. Combining the modeling with experimental results on laboratory scale tests and on the larger component scale, a Lab-to-Field upscaling tool will be generated to bridge the gap between the model and larger scale component tests. By modeling based Lab-to-field up-scaling tool it will be possible to decrease the number of expensive component and higher scale experiments and thus achieve more cost-effective materials up-scaling for tribological applications.

### Speaker Biography

Ronkainen Helena is a Principle Scientist at VTT Technical Research Centre of Finland. She obtained her M.Sc. degree in Mechanical Engineering and Dr. (Tech) degreed in Materials Science from the Helsinki University of Technology (at present Aalto University). She has worked in the field of tribology over 30 years and carried out tribology research to provide solutions for energy and material efficiency and she has more than 90 papers in peer-reviewed international scientific journals. The main areas of interest have been surface coatings and materials to provide low friction and high wear resistance for various applications, including the use of computer modeling and simulation to increase the understanding of wear phenomena. Her current research interest has been the wear resistance of polymers, particularly the abrasive wear performance of polymers.

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