Modelling assisted sliding-impact wear of coatings and surfaces

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Introduction

It is a simple idea; industrial sectors have often needed to investigate industrial wear processes. These involve complex interactions between different bodies which may define the rate of wear and surface damage. The authors wish to understand how sliding and impacting contacts affect the wear of different material systems using a repeatable methodology. The materials investigated are defined as bulk elasto-plastic materials (spherodised pearlitic cast iron, AISI316L steel), composite hard coatings (HVOF WC-Co-Cr, etc.) and viscoelastic polymers. The work involves collaboration between the University of Sheffield, Technical University of Tampere and VTT Technical Research Centre of Finland.

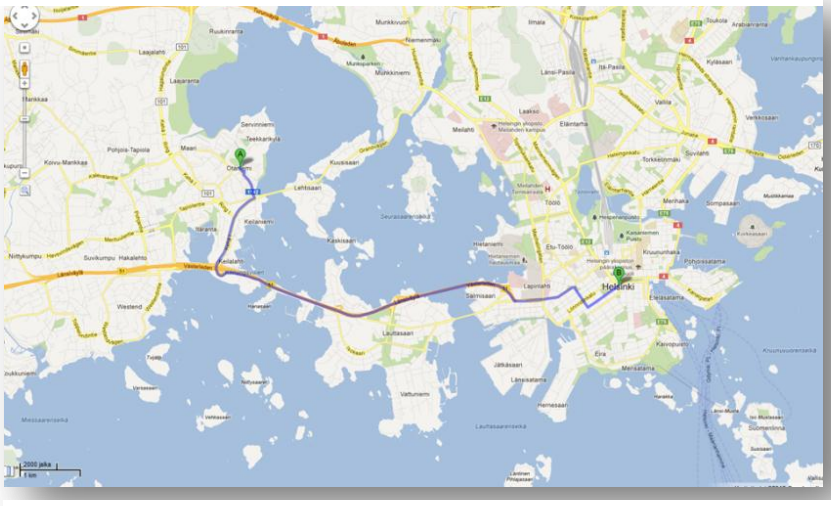

Figure 1 - Otaniemi (a) and downtown Helsinki (b)

One of the merits of this studentship is that there is a strong collaboration between academic and industrial partners. From an academic perspective, my work involves The University of Sheffield, VTT Technical Research Centre of Finland and the Technical University of Tampere. These institutions are working closely on funded projects with Finnish companies including Ruukki, Metsä, Wärtsilä, KONE, KONECranes, Teknikum OY and Componenta OY. This leads to a wide range of research interests and approaches which encourages my work to be relevant to current industrial and scientific needs.

Empirical testing

A range of test methods are used to assess different material and wear behaviours. In brief, specific tests are used to replicate short term and long term sliding or impact wear. For example, scratch testing is used to assess short distance sliding contact, whereas normal-impact fatigue testing examines high cycle impact conditions.

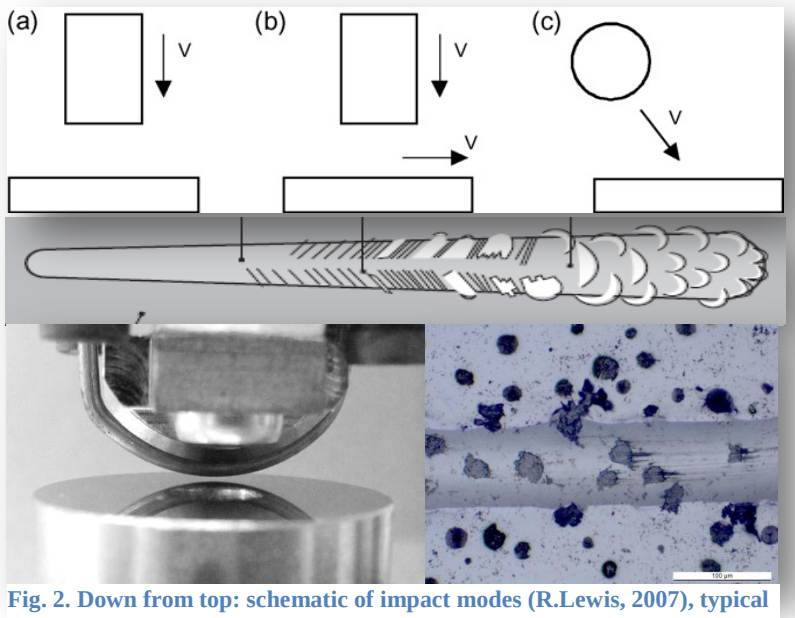

Fig. 2. Down from top: schematic of impact modes (R.Lewis, 2007), typical progressive load failures for DLC coatings, novel steel wire scratch slider (R.Waudby *et al*, 2012) and scratch track for spherodised cast iron

Modelling and simulation

As an extension to activities in VTT and TUT; a model is being developed using a peridynamics approach to evaluate the fracture of tungsten carbide coatings on steel substrates, under high energy, single impacts. It is planned that this will be presented at the World Tribology Congress 2013 event in Torino. The work is experimentally validated with controlled apparatus.

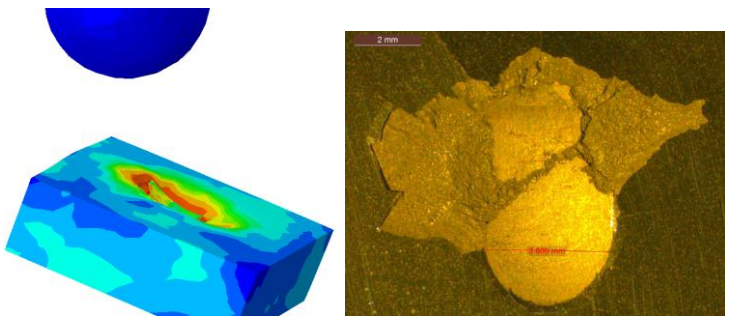

Fig. 3- Peridynamic model of impact event (M.Lindroos, TUT), left, and an impact site from a WC-10Co-4Cr coated sample, right. The impact energy was nearly 55J.

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