DEVICE FOR TESTING OF COATINGS UNDER SURFACE FATIGUE WEAR CONDITIONS

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The thickness of the coatings is usually very small comparing to dimensions of a component. Applying of the coating is one of the surface engineering methods. Difference in mechanical and thermal properties of coating and substrate material leads to generation of additional stresses (comparing to uncoated material) under surface loading. In applications with repetitive (cyclic) dynamic stresses it is required to estimate the ability of the coated surface to resist initiation and crack growth intensity leading to the surface damage (wear).

Device for surface fatigue wear (SFW) testing of coatings and bulk materials under dry conditions was built in Tallinn University of Technology (TUT) in year 2008 due to the growing interest in thin coating studies and purchasing of new PVD coating station (Platit). It came to the fact that the properties determined in single loading mode (adhesion, hardness, resistance to scratching, etc) are not sufficient to rank the behaviour of coatings in long run regimes with repetitive dynamic conditions (stamping, cutting, impact drilling etc). Device makes it possible to initiate the crack growth starting from microstructural defects or stress concentrations thus helping to improve the coating technology. It is possible to observe deformation of the coatings and substrates enabling proper substrate or interlayer selection.

The ball made of hard material is used as indenter and is repeatedly pressed into the test sample. The ball can rotate in holder enabling gradual wear of indenter around the periphery. It is also possible to use balls or buttons as test samples when testing them against some hard material (drilling bit against rock).

The main parameters that are set during the test are impact energy and the frequency of the impact. It is possible to change velocity and mass of the elements that produce impacting energy. The test is stopped after certain number of impacts to check the evolution of the surface wear. The rigidity of the impact could also be varied by energy damper attached below the specimen. Surface and subsurface (on transverse section) damage is observed by optical and SEM microscopes. Qualitative and quantitative evaluation methods are available. Several articles are already presented/published on the basis of obtained results using SFW by TUT. Two articles are in preparation. Cooperation is warmly welcomed.