

High Pressure Liquid (With/Without Solid Particle) Impingement Erosion Test (ASTM G 73 / ASTM G 76)

This test set-up may be used for evaluating the erosion resistance of materials when solid surfaces are subjected to repeated impacts by liquid droplets and solid particles (Fig 1) or only with liquid droplet impact to evaluate materials exposed to a cavitational liquid environment. The erosion process can involve several wear mechanisms, typically occurring by plastic deformation or by brittle fracture (Fig 2). Few semi-empirical models relate the erosion wear resistance: i) to material properties (the hardness, the fracture toughness and the elastic modulus) and ii) to other features linked to the testing process, e.g. erodent shape, density, speed and size. This set-up can simulate the wear process in many harsh erosive and corrosive environments, for example, blades in water turbines (Fig 3). The impingement medium can be water, artificial sea water or fluids with additives. The impingement angles have a considerable influence on the erosion resistance of materials as shown in Fig. 4, as well as the content and nature of the erodents. The testing set-up parameters:

Sample geometry (if tensile load shall be involved):	140x40x4 mm
Sample geometry (without additional tensile load):	40x40x4 mm
Solid particle erodent concentration:	from. 0.001 to 0.1 wt.-%
Impingement angle:	30° up to 90°
Stand-off distance between nozzle and sample surface:	50- 200 mm
Water jet pressure (at exit):	up to 250 bar

Typical Standard Method

This testing set-up combines both Standard test methods ASTM G73 and ASTM G 76

ASTM G73: standard test method for liquid impingement erosion and **G76:** standard test method for conducting erosion tests by solid particle impingement

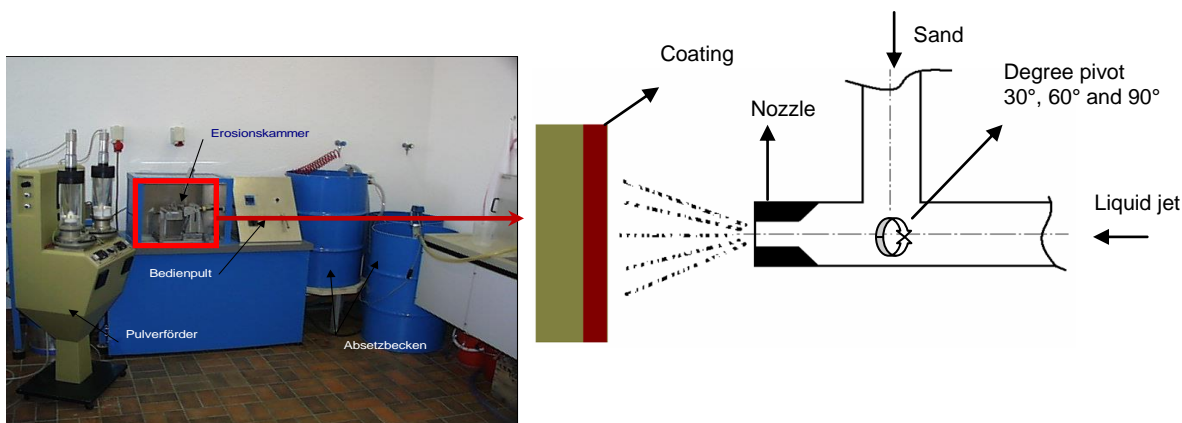


Figure 1: High pressure liquid and solid particle impingement erosion set-up

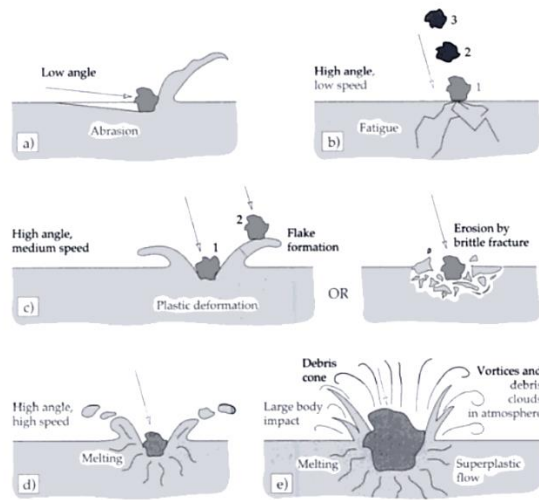


Figure 2: Schematic presentation of several wear mechanisms dominating erosive wear process by single particle erosion. (Ref: Engineering Tribology (2nd Edition), 2001)

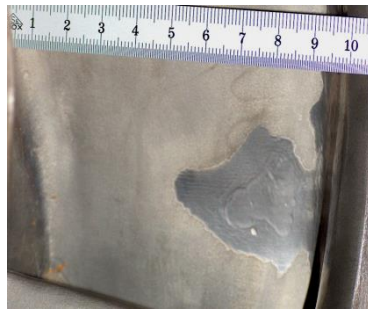


Figure 3: Typical erosive wear on the edge of water turbine blade (Ref: Hadad_ITSC 2007).

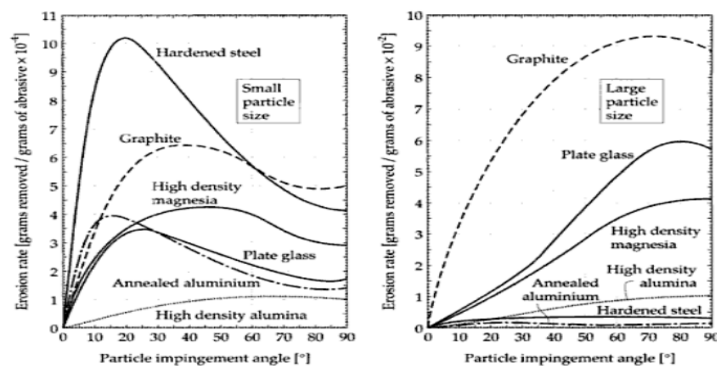


Figure 4: The influence of different solid particle materials and impingement angles on the erosive wear resistance. (Ref: Engineering Tribology (2nd Edition), 2001)

Example of erosion test ⁽¹⁾:

Erosion test was performed on a WC-Co-Cr HVOF thermally sprayed coating on a steel substrate. The worn surface is shown in Fig 5.

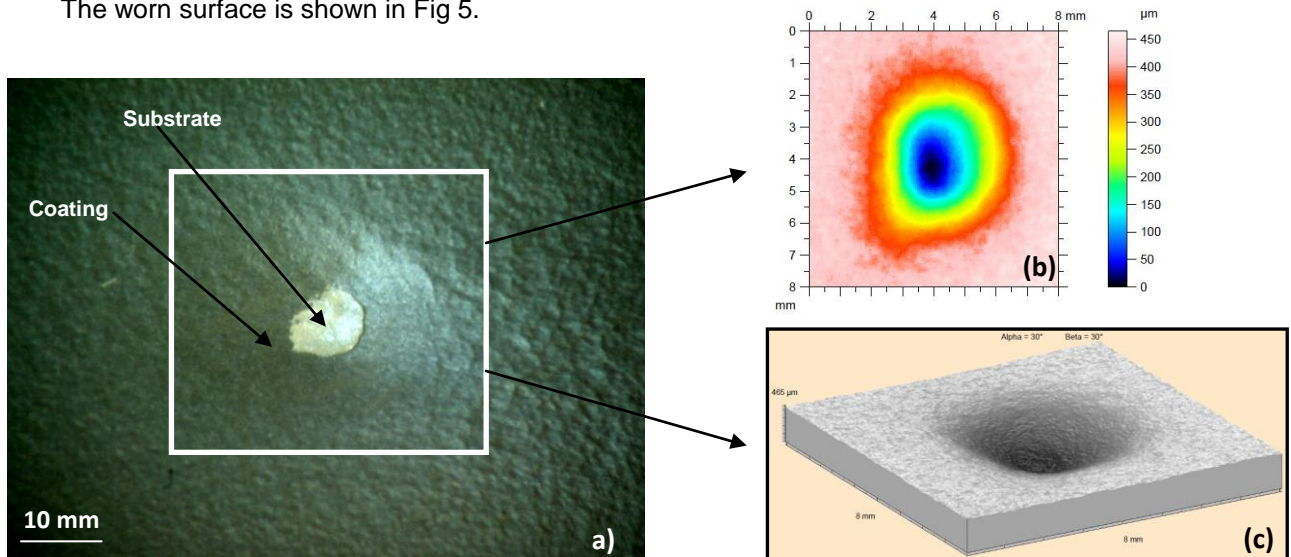


Figure 5: a) The micrograph of worn surface morphology of coating caused by erosive wear, b) upper scanned topographic surface by White-Light profilometer (Altisurf 500-Cotec), c) 3D topographical measurements of the worn surface, d) metallographic cross sectioned of coated samples with impingement angles at 30° and 90°.

⁽¹⁾Hadad_Surface & Coatings Technology_2008