

Shear testing for characterizing the adhesion and cohesion of thermally sprayed coatings (EN 15340)

Most of the conventional standardized testing methods for the determination of the adhesive and cohesive strength of thermally sprayed coatings do not present the relevant failures of the coated component in real service. In addition, those methods require expensive preparation steps of the test sample (e.g. use of adhesive and curing of adhesive agent, etc). More recently, a shear loading method has been developed which represents most of the generally occurring failures in manufactured, coated parts. In addition, it characterizes reliably the mode of failure of thermally sprayed coatings and is simple and fast as it does not require the use of an adhesive agent or curing at temperature.

Typical standard method:

EN 15340: European standard test method EN 15340 for the determination of shear load resistance of thermally sprayed coatings.

The shear test device:

The principle of the testing set up is shown in the Fig 1. The shear plate is made of conventional tungsten carbide cutting tool and fixed close to the high precision load cell. The wedge of the shear plate is parallel to the interface coating/substrate and parallel to the upper face of the sample. Thus a uniform loading of the coating is ensured. This shear plate is capable of delivering a maximum force of 20 kN. The worn cutting plate can be easy changed.

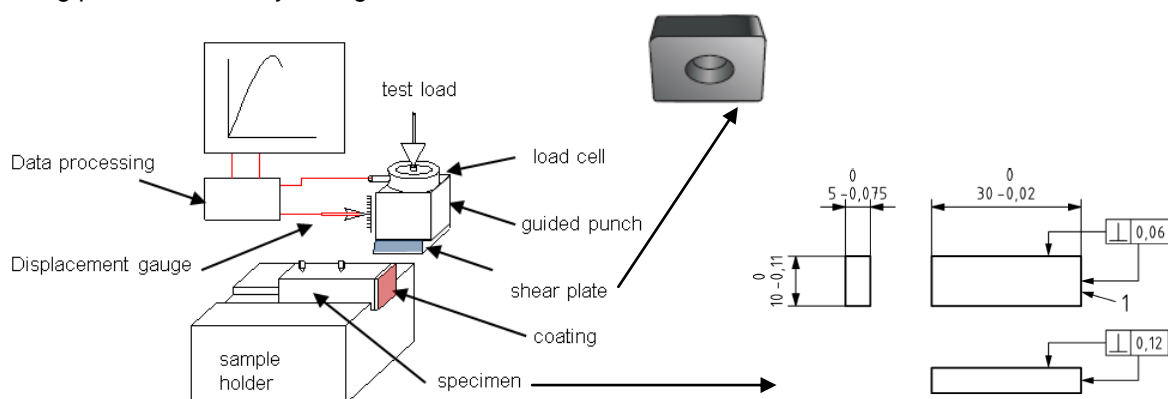


Figure1: Shear test device and the testing sample dimensions

Adhesion – cohesion failure of coatings:

Different failure modes can be deduced from the force - displacement curves and coating failures (Fig 2 & 3), relating the nature of adhesion to cohesion: **Mode I**: adhesion < cohesion, **Mode II** : adhesion \cong cohesion, **Mode III**: adhesion > cohesion. More detailed coating failures are given in the Norm EN 15340.

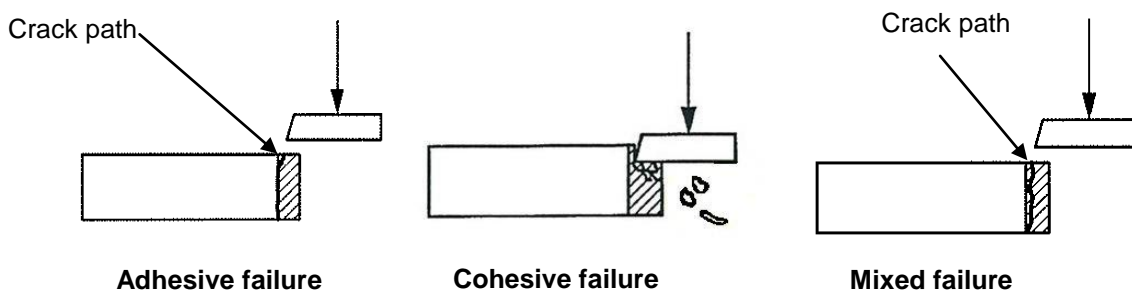


Figure 2: Schematic presentation of different coating failures modes [Ref 1]

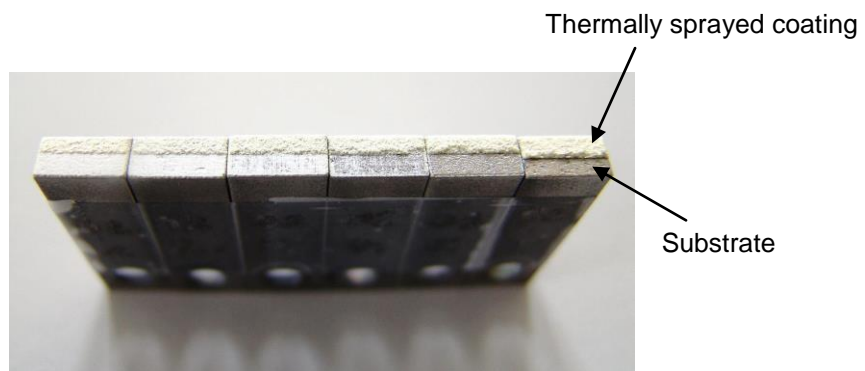


Figure 3: Six shear test samples with bond coat and thermal barrier coating in decreasing shear distance (from left to right) showing purely cohesive failure.

[1] ITSC 2005_Siegmann_et al. "Shear Testing for Characterizing the Adhesive and Cohesive Coating Strength Without the Need of Adhesives".