

APPLICATION NOTE

Application of FISCHER products

AN037en

Mechanical characteristics of anodised coatings

In the automotive industry weight reduction – and the associated fuel savings – are top priority, which is why lightweight materials such as aluminium are used. In order to withstand mechanical stresses, however, these softer components must be made wear resistant. For this reason, hardcoat (Type III) anodisation is becoming ever more common.

While hard anodised coatings are typically 30-80 μm thick, some are only a few μm ! For these coatings, conventional hardness measurement systems that rely on optical evaluation of the indentation (e.g. Vickers method) approach the limits of their ability. A much better suited method is the instrumented indentation test, which can be applied to measure not only the hardness in terms of plastic deformation (HV), but also to assess other quality-determining characteristics. Using the instrumented indentation test, even very thin anodised coatings can be analysed without risking influence from the substrate.



Fig.1: Hard anodised piston

For such technical applications hard anodised coatings must have a consistent hardness of 400-600 HV across the entire section. Soft anodised coatings for decorative applications have a hardness of about 200-400 HV, which is reached a few hundred nm below the surface.

The FISCHERSCOPE[®] HM2000 with its ESP (Enhanced Stiffness Procedure) mode is able to determine mechanical properties like the Vickers hardness or the elastic indentation modulus dependent upon the depth.

Figure 2a/b shows the Vickers Hardness HV (calculated from the indentation hardness H_{IT}) and the indentation modulus E_{IT} of two coatings: a hard anodised coating (480 HV) of 11 μm thickness (shown in red) and a soft anodised coating of 14 μm thickness (shown in blue). The higher standard deviation for the hard anodised coating stems from the roughness of its surface.

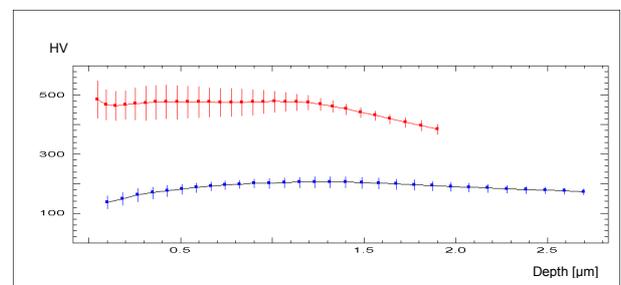


Fig.2a: derived data for Vickers hardness (HV) of a hard anodised (red) and a soft anodised (blue) coating

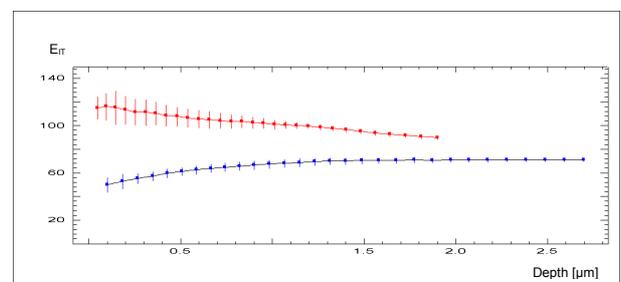


Fig.2b: indentation modulus (E_{IT}) of hard anodised (red) and a soft anodised (blue) coating

In Figure 2a one clearly sees the consistent hardness of the hard anodised coating and the increasing hardness of the softer anodised coating, which also exhibits less elasticity (Figure 2b, indentation modulus). On the hard anodised coating, the elasticity decreases as one approaches the substrate.

The FISCHERSCOPE[®] HM2000 is optimally suited for the precise determination of the mechanical characteristics of thin anodised coatings. Beside the hardness, other parameters such as the plastic or elastic material characteristics can be accurately assessed. Please contact your local FISCHER representative for further information.

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