Hardness measurement of nano coatings on eyeglass lenses

Whether used for eye protection or vision correction, plastic eyeglass lenses are preferred over glass for their considerably lower weight and better fracture strength. In order to provide the required life-long quality of such lenses a specific scratch-resistance is necessary.

Current eyeglass lenses made of plastic are commonly provided with an anti-scratch, dirt-repellent and anti-reflective surface. They are vacuum coated using a physical vapour deposition (PVD) method with up to 10 protective layers, each only a few nanometres thick, which together ensure very high scratch-resistance. Hardness and scratch-resistance of these coatings are directly related: therefore, determining the hardness is a suitable method for quantifying the quality of these protective coatings.

To avoid commingling the hardness results of the coatings with those of the base materials while measuring, the test load must be absolutely minimal, as low as a few micronewtons: The indenter may only penetrate up to one tenth of the overall coating depth in order to correctly determine its hardness without being influenced by the properties of the substrate (Bückle’s-Rule).

Another important measuring parameter is the elastic/plastic deformation ratio of the coating material. The coatings must have a very high elastic component to prevent separation from the base material upon deformation. Therefore, multilayer coating systems are used that gradually adjust the modulus of elasticity from the base material to the top coating. These systems also have much higher adhesive bond strengths compared to single-layer coatings.

To secure the functionality of these protective coatings it is important to find the right balance between hardness and elastic behavior.

The PICODENTOR® HM500 is ideal for measuring the hardness and elastic properties of these complex, nano-thin multi-coatings, which requires a measuring system capable of load generation as low as a few micronewtons and highly accurate depth measurement in the picometre range – exactly the designed operating range of the PICODENTOR®. The hardness can then be calculated from the measured load/depth curves. For further info contact FISCHER (860)683-0781 or info@fischer-technology.com