



Seeing beyond

ZEISS Metrology Expert Tip



**carbon fiber is the best
material for extensions**

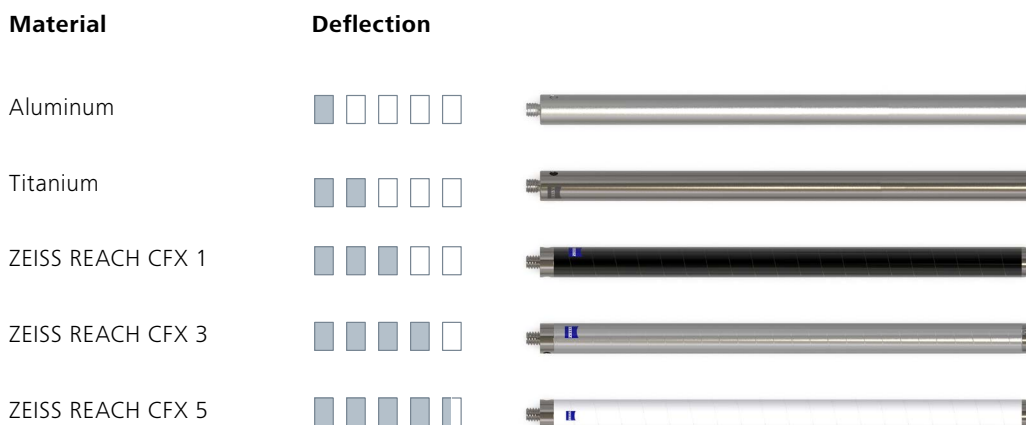
Do you know why carbon fiber is the best material for extensions and offers an upgrade in terms of accuracy?

Reliable measurement results are a must in order to distinguish good components from rejects. These can only be obtained if the overall measurement uncertainty is kept as low as possible.

The use of unsuitable extensions has a direct negative influence on the measuring process and thus worsens the measuring accuracy that a CMM can achieve according to specification. The influence of the extension on the measurement uncertainty is mainly due to three factors: weight, thermal expansion and static stiffness.

For this reason, the material of the extension plays a decisive role, as it has the greatest influence on these factors. Let's take a look at the development of the extension. The first generation of extensions were made of aluminum, then titanium and today carbon fiber is used. Carbon fiber has a decisive influence on all three factors. One of the most important factors is stiffness, as it can significantly reduce vibrations that occur with suitable winding.

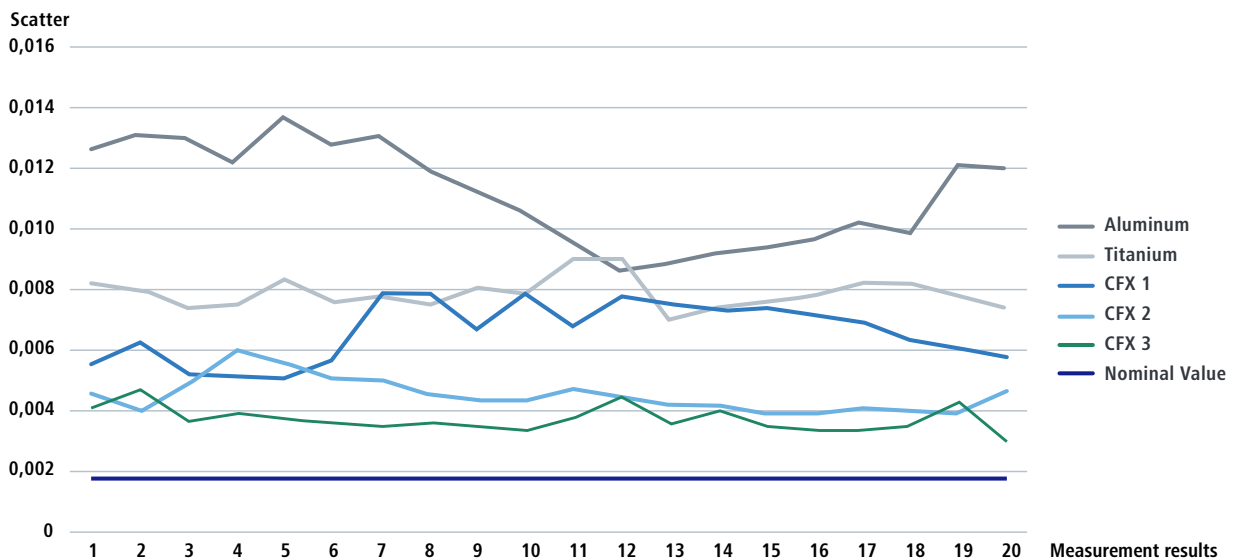
Stiffness comparison of the different extension materials



Despite their relatively good stiffness, aluminum extensions have long been out of date due to their poor thermal expansion and high weight.

Titanium extensions had to be reduced in diameter and wall thickness for weight reasons and therefore have poor stiffness and are not recommended for accurate measurements.

The stiffness is achieved by the type, the unique winding and the number of layers of carbon fiber. This results in a very low scatter in the measurement results, as the diagram below shows. It also shows that not only the absolute accuracy, but also the stability of the measurement results decreases in line with the quality of the extension. The choice of extension material therefore has a decisive influence on the reproducibility of a measurement.



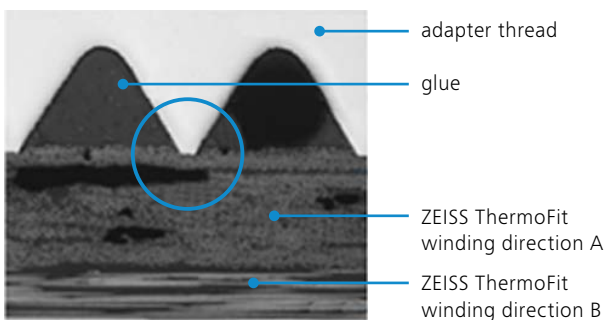
A stiffer extension enables you to scan your work piece faster and thus increase your productivity.

Why can an adhesive gap make the measurement inaccurate?

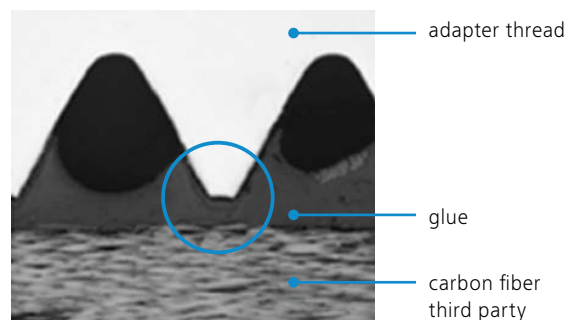
Hysteresis occurs when the styli do not return to their original position after being probed. This always happens when the connection between the tube and adapter of carbon fiber stylus extensions is only realised via a bond with an adhesive gap. This effect is noticeable through an increased standard deviation, for example during the calibration process.

A secure connection is a combination of adhesive bonding and a cut-in thread adapter. The direct contact between the adapter and the pipe creates an optimum frictional connection. This can be clearly seen in the following sectional views.

ZEISS CFX REACH extension with cut-in thread adapter



Extension without cut-in threaded adapter



ZEISS Original Accessories are available in the ZEISS Metrology Shop.

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