MIRION TECHNOLOGIES

TCAM – Ruggedized CAM Detector

Abstract

The TCAM detector is a ruggedized version of a standard CAM detector, especially designed to be used in harsh conditions such as marine applications or stack applications. The CAM aluminum light tight layer and varnish layer are replaced by one single T-layer. This T-layer provides excellent acid resistance and is scratch hard. It is also thinner, 1 µm compared to 1.5 µm silicon equivalent thickness, than the traditional layer resulting in less straggling. Further, there is no change in efficiency or noise performance compared to a CAM detector.

Scratch hardness

To compare the scratch hardness of a TCAM detector to a CAM detector, both detectors were subjected to the same linear taber tests [1]. The total load onto the detectors was 417.7 g, the stroke speed 30 strokes per minute. Tests were done with a total of 10, 30, 50 and 100 strokes. In Figure 1 pictures taken through optical microscopy are shown for 50 and 100 strokes for the CAM and TCAM detectors. Already from these pictures it is clear that much more damage was done to the CAM detector than the TCAM detector.

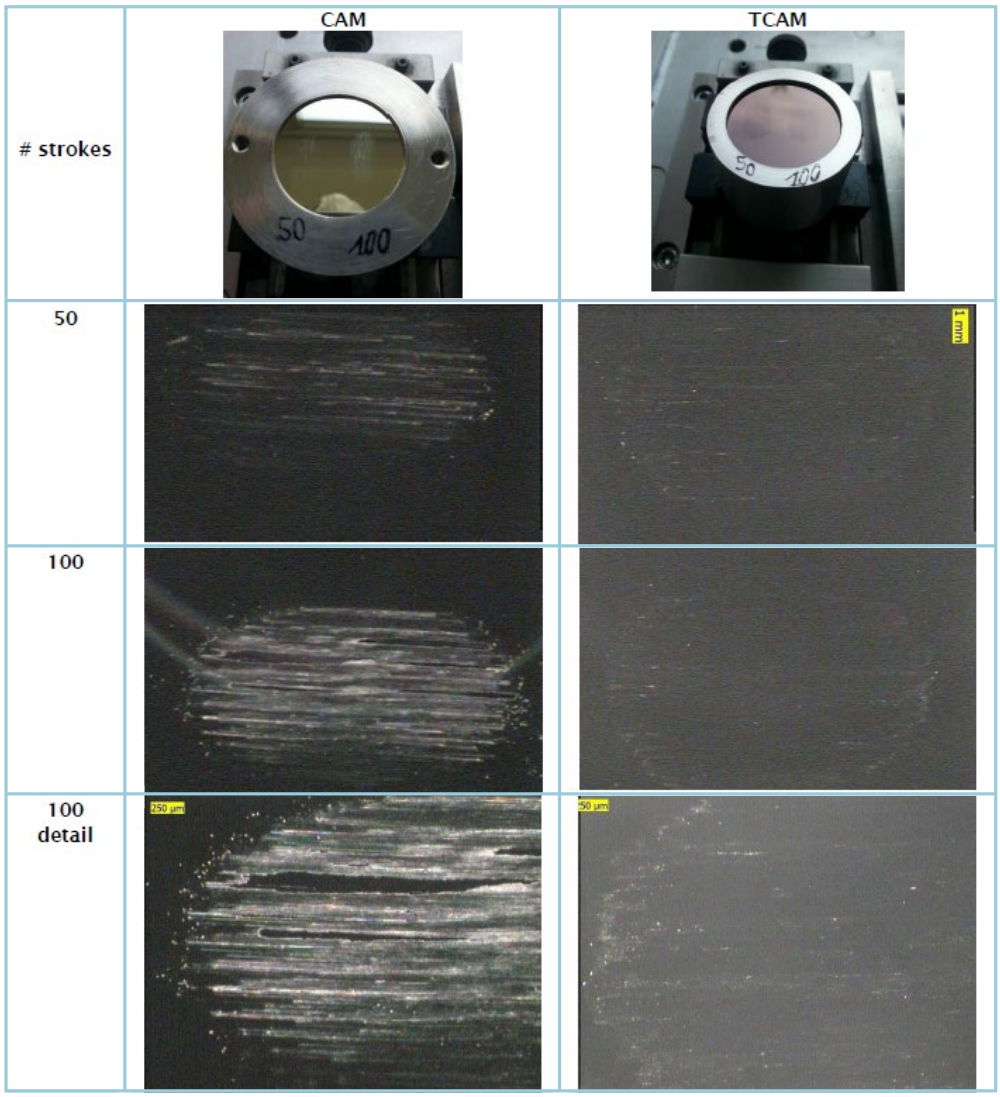

Figure 1
Abrasion damage of the CAM and TCAM detector for 50 and 100 strokes [1].

The detectors were further analyzed with confocal microscopy, which shows a 3D image of the roughness over a surface of 250 x 200 µm. Figure 2.a shows a part of the surface of a CAM (left) and TCAM (right) detector that was not subjected to the abrasion test. Figure 2.b and c show parts of the surface of a CAM (left) and TCAM (right) detector that were subjected to 100 strokes in the abrasion test. The line underneath each graph shows a 2D curve of one line of which the 3D image is built.

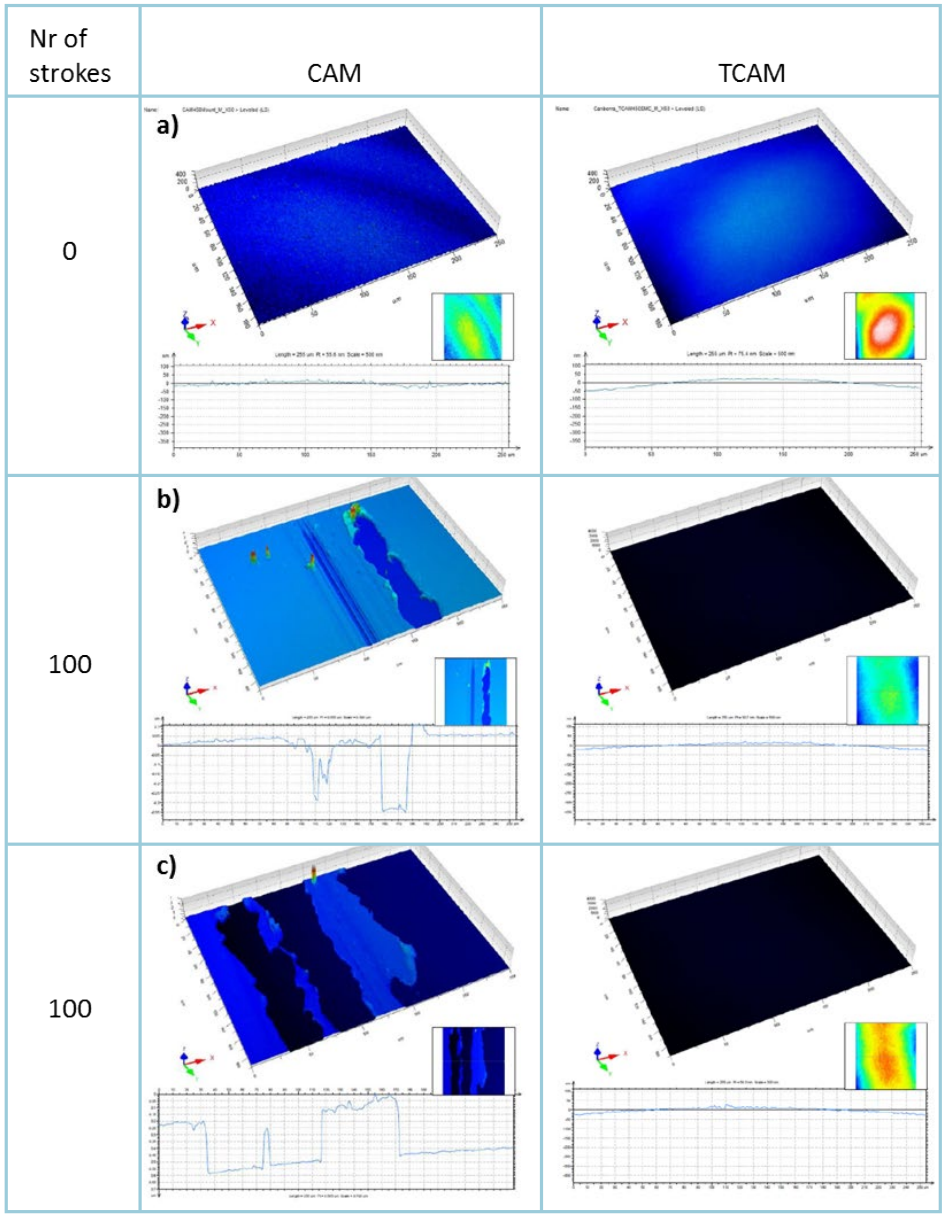

Figure 2
Image of the surface of a CAM (left) and TCAM (right) detector for a) 0 and b) and c) 100 strokes.

The surface of the CAM detector shows scratches up to about 400 nm deep. The TCAM surface does not show any increased roughness compared to the part of the surface that was not subjected to an abrasion test.

These abrasion tests clearly show that the TCAM is much more resistant to scratches than the CAM detector. Even a taber test with 100 strokes did not show a measurable increase in roughness of the surface.

Acid resistance

According to Reference [2], the T-layer is very resistant to etching with HF (1 part to 10 parts H_2O), acetone, methanol and isopropanol. In-house tests showed no indication that the T-layer is less acid resistant than the standard CAM layer. No measurable etching of the T-layer occurred after a 20 min exposure to HNO_3, H_2SO_4 and NaHO. An exposure of 20 minutes to HF resulted in an etch rate of 17.5 nm/min for the T-layer. In another test, a solution of HCL (35%, 3 parts) and HNO_3 (75%, 1 part) was deposited for 20 minutes onto the T-layer. Only a very small etching occurred of the T-layer. The detectors were still perfectly light-tight and a roughness of the surface of the detector of only 12 nm existed.

Of course, not only the protection layer on top of the detector is important, but also the elastomer that is used to make contact between the detector surface and the housing. Depending on the application a different elastomer can be used. We recently changed to a new acid resistant rubber that is compatible with most frequently used chemicals.

References

[1] Sirris, *Report 6-1407*, June 2016.

[2] K. R. Williams, *Journal of Microelectromechanical systems vol. 12 no. 6*, December 2003.