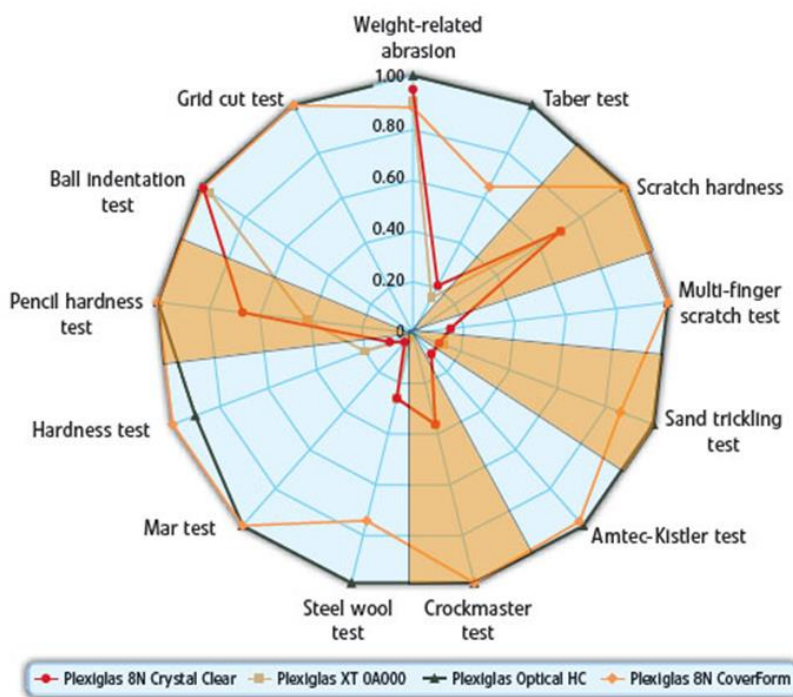


## SOLID-FS™

### Scratch Resistance Additive for PMMA, Nylon, Polyesters

For PMMA, as for all thermoplastics, scratch resistance means different things to different applications and markets. In truth, materials testers use many different methods to determine the scratch resistance of these materials. To add to the confusion, the terms “scratch”, “abrasion” and “mar” are commonly used interchangeably.

The recent publication “*Minimising Scratch Marks*” written by staff at Evonik Industries AG <sup>1</sup> details the multitude of possible tests for scratch, abrasion or mar resistance. The article confirms that scratch/abrasion cannot be clearly defined by any one mechanism completely. For any given mode of scratch/abrasion some tests will show significant difference, some less so, and others none at all. This can even apply to comparisons between host acrylic and a hard coat. So we need to match a product's particular real world 'scratch' to a test, which may vary from product to product.



The shaded segments on the diagram show the ideal tests for SOLID-FS™:

- Pencil hardness
- Erichsen scratch hardness
- Sand trickling test
- Crockmaster test (soft mar)

Figure adapted from “*Minimizing scratch marks*” *Engineering Plastics*, 01/2014

TenasiTech SOLID-FS™ is recommended for those end uses requiring outstanding performance according to testing such as: **Pencil Hardness, Erichsen, Sand-trickling, Crockmaster.**

Pencil Hardness has been shown to increase from 3H for the virgin PMMA to **7H with SOLID-FS™.**

The **Sand trickling test** has shown lower levels of abrasion for the SOLID-FS™ composite PMMA compared to the virgin PMMA equivalent. The effects were most obvious when 100g and 200g weights of sand are applied to the surface.

<sup>1</sup> *Minimizing Scratch Marks*; Kilian, P & Arndt, Dr. T, Evonik Industries AG; published in “*Engineering Plastics*”, *Kunststoffe international* 1/2014

# Understanding Scratch Resistance

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TenasiTech has demonstrated that a modified **Crockmaster test** shows improvements for the SOLID-FS™ composite PMMA. This test was performed with a soft polishing cloth for 8,000 and 40,000 cycles and under multiple loads.

These modes of measuring scratch/abrasion are highly relevant to automotive, consumer appliances, mobile devices and home surface applications.

The additive will not, however, provide protection against more aggressive, gouging type scratching. Tests such as Multi-finger scratch and Taber abrasion can be very aggressive, and differentiating between polymers very difficult.

However, we *have* seen anti-scratch benefits with SOLID-FS™ using the **Multi-finger Scratch at lower loads** (~3-5N). This is sensible when we consider that if we use a sharp point, such as used in an Erichsen test, the accepted critical scratch load for a virgin PMMA surface is around 0.7N. Under this test we have shown that PMMA with SOLID-FS™ can achieve 2N, and this has been confirmed by external sources. In fact we measured up to 2.2N when TenasiTech used a modified tribometer which recorded both friction and load, allowing us to determine exactly the load at which scratching occurred.

**NOTICE:** These suggestions and data are based on information we believe to be reliable. They are offered in good faith, but without guarantee, as conditions and methods of use of our products are beyond our control. The information in the publication is to the best of our knowledge at the time of publication. Nothing herein is to be construed as a warranty, expressed or otherwise. In all cases it is responsibility of users to determine the applicability of such information or the suitability of any product for their own particular purpose. The sale of any products referred to in this publication is subject to the general terms and conditions of TenasiTech Pty Ltd. Version 1, July 2015.

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