

Scratch and Dig

ANSI approves new surface imperfection standard

The American National Standard for optics surface imperfections, OP1.002, has been revised by the American Standards Committee for Optics, ASC/OP, and the change was approved by the American National Standards Institute for distribution. The new version, OP1.002:2009, represents a significant advance for the American optics industry, especially laser optics manufacturers and users, as it allows either a visibility method or a dimensional method for scratch and dig specification. The prior version offered only the visibility method, based on MIL-PRF-13830B.

Scratch and dig specifications are among the most misunderstood and misused notations in the optics community. Although the original surface imperfection standard established by the Army in 1945 has not changed significantly in more than 50 years, there is confusion in industry as to whether you can use high intensity illumination (you can't) or magnification (only under specific conditions, and only to 4x), or even measure the scratches under a microscope, rather than judge the visibility of the scratches subjectively, as the standard requires. The visibility method of OP1.002, first released in 2006, cleared up much of this confusion by streamlining the surface imperfection sections of MIL-PRF-13830B, clarifying the language and providing diagrams of the test methods that are allowed. While an improvement, the standard did not address the subjectivity of the test, or the needs of the laser optics community for a method to control actual dimensions of imperfections down to one micron or even less.

Part 7 of ISO 10110, the international drawing notation standard, provides a dimensional method of specifying surface imperfections which is based on the German DIN standard 3140. Some users of that standard, however, complain that it is too costly to implement as it requires the measurement of every scratch and dig against a chrome on glass comparator, and the accumulation rules are obscure and difficult to implement. As a result, it has not been accepted in the US as a national standard.

The new version of OP1.002 retains the visibility method, but also incorporates the dimensional method used in MIL-C-48497 and MIL-F-48616, which specifies the scratch width in microns. This allows for a more objective specification and validation using either visual comparison or microscopy. But unlike the MIL standards, it adds the capability to specify scratches and digs smaller than 5 microns. It is available for purchase in .pdf form through the ANSI Online store, or in paper form from OEOSC.

All of these standards and more are the subject of my course Understanding Scratch and Dig Specifications, to be offered at OptiFab in May. In that course we discuss all the pitfalls and problems associated with the various methods of specifying scratch and dig, and review how to pick a specification for your application. Particular attention is paid to the new standard, OP1.002:2009.