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On the Lookout for **Microparticles**

With their modern measuring technology for fluorescence spectroscopy, Schott experts can detect impurities of less than 50 ppb in optical materials.

With fluorescence spectroscopy, the material sample is exposed to the light of a 450-watt xenon lamp. The light converted into fluorescence reveals the kind and level of impurities.

Customer requirements regarding the properties of optical glasses and crystals have become extraordinarily exacting, confirms Dr. Axel Engel, Scientific Advisor in AMS (Analysis Measurement Service) of the Research and Technology Development Department at Schott Glas in Mainz. This is particularly true of materials that are used for high-intensity light sources such as lasers. They are only allowed to absorb minimal amounts of light, otherwise they might negatively influence the functions of the product. As part of the company's internal quality control system to verify guaranteed properties, Schott is now able to reliably measure even ultratrace impurities in optical materials in the range of parts per billions by means of fluorescence spectroscopy.

Revealing luminescences

Scientist Dr. Engel describes the principle as follows: "When optical materials are exposed to light, and especially UV light, this light is partly absorbed. In some cases, luminescence – i.e. a distinct brightness – is ob-

Modern measuring technology makes it possible to detect traces of individual elements in optical materials at levels of less than 50 ppb (50 parts per billion).

served. We can attribute this characteristic luminescence to very specific and unwanted impurities."

Additional elements or impurities in optical materials are already decisive in ranges of less than millionth ppm – a detection limit that until now has been reserved for chemical analyses. However, there have always been serious disadvantages. For one thing, this method is time- and cost-intensive, and for another, it cannot be performed without damaging the samples. This means that the samples in question cannot be used after the analysis.

Fluorescence spectroscopy, in contrast, offers distinct advantages. In concrete terms, this means a representative material sample is taken from a production batch to determine the fluorescence. For this purpose, it is exposed to the light of a 450-watt xenon lamp in the sample chamber of the spectrometer. This kind of excitation source emits light both in visible and in UV ranges. Because of the generally low level of impurity of optical glasses and crystals, a light source of extremely high intensity must be used in order to produce the luminescence. Optical components filter out the characteristic lines from the light emitted from the xenon lamp. The light absorbed in the sample and converted into fluorescent rays is dispersed in a second monochromator to provide the instrumental evidence.

Giving customers a competitive edge

To evaluate the fluorescence, the scientists take reference samples for a comparison. In specified wavelength ranges, these have defined optical properties that have been adjusted according to the intended practical application of the sample material and are used for quality testing.

"We use comparable spectra from scientific literature and results from model calculations to identify the observed spectral lines. The share of impurities is then extrapolated from the results of the chemical analysis," explains Dr. Engel, who also reveals the ambitious plans for the future. "We will extend the detection possibilities to additional elements and to set up a reference spectra database to be able to quickly prove the prescence and measure the level of impurities. The precision of this complex analytical investigation based on a combination of modern measuring technology, extensive evaluation know-how and detailed material knowledge is what gives our customers a competitive edge in the market." ◂