TEST APPARATUS FOR DETERMINING RESISTANCE TO LIGHT AND WEATHER INFLUENCES

This invention is concerned with test apparatus for determining resistance to light and weather effects on inorganic or organic pigments, plastics or lacquers. More particularly, such apparatus may include a chamber with at least one radiation source and at least one fastening arrangement for a sample which at least in part consists of a material to be tested.

BACKGROUND AND PRIOR ART

Testing of inorganic and organic pigments, plastics, or lacquers with regard to resistance to action of light and weather may involve exposing samples to naturally occurring light and weather conditions. Alternatively, to shorten the test period, exposure may be by means of apparatus for accelerated weathering having a high-intensity radiation source which typically has an enhanced ultraviolet component. In either case it has become apparent that mere correlation of test results to duration of exposure leads to widely scattered results, due mainly to variation in light intensity and spectral composition during sample exposure. In particular, meaningful comparison of test results is often impossible when test apparatus for accelerated weathering of different design are used, especially when different radiation sources are involved such as, e.g., carbon arc, xenon, mercury vapor, or fluorescent lamps.

In known radiation measuring devices various filters may be interposed between a radiation source and a radiation detector, thereby providing means for recognizing (at least qualitatively) changes of the radiation used in one or another of selected narrow spectral ranges. In one such known device, an exchangeable filter can be interposed between a radiation source and a radiation detector. In another, well-known radiation intensity measuring device, three different filters are interposed in consecutive time periods, and the radiation intensities of the three corresponding wavelength intervals are measured in turn. Both devices are suitable only for the determination of radiation from xenon arc lamps.

Such devices are insufficient for several reasons. It is known that the decomposition behavior of binders or pigments is strongly dependent on the spectral composition of incident light. Accordingly, there is a need to expose samples to radiation which is tuned to the photoactive region of such binder and/or pigment. This, in turn, calls for a radiation intensity measuring device which is selectively sensitive to one or several desired spectral regions.

Furthermore, uniformity of sensitivity in a spectral region is not assured in known devices; intensive irradiation tends to cause unnoticed and uncontrollable changes in the properties of bell-jar and interference filters. Such changes lead to considerable uncertainity as to just how much radiation the samples were exposed to and this, in turn, results in the well-known, undesirably wide range of scattering of measured values obtained from test apparatus, especially when measurements of intensity are made in the ultraviolet spectral region (which here is of special interest).

If a device includes only one filter, no detailed information is obtained about intensity as differentiated according to wavelength of radiation incident on a sample. If, however, a device includes three filters, filter changing may preclude reliably taking account of short-term variations of radiation intensity.

In practice, exposure time is often used instead of radiation dosage as a measure of readiation incident on the samples. This method depends on constancy of distribution of radiation and constancy of intensity of the radiation sources (i.e., ambient radiation under natural conditions and artificial radiation under accelerated test conditions); such constancy is usually not assured in practice.

THE INVENTION

It is an object of the invention to provide for test apparatus for determining resistance to action of light and weather, such apparatus having an adaptable radiation measuring device (i.e., a device having one or several sensitive ranges which can be adjusted to coincide with one or several ranges which are optimal for irradiating the samples). As a benefit of the invention, testing may proceed without recalibration and adjustment of test apparatus in the course of irradiation.

In accordance with the invention, the radiation intensity measuring device includes means for the spectral dispersion of radiation and means for detecting radiation which are adjustable so as to permit measurement of radiation intensity and/or dosage in at least two specifiable spectral regions, radiation typically being ultraviolet radiation emitted by a radiation source and transmitted by a light guide.

A radiation detector may advantageously consist of an array of photodiodes. It is advantageous further if several light guides, originating from several points in the test apparatus, lead to the radiation measuring device input, where the combined radiation from light guides can be measured in a desired spectral range. This allows for averaging inhomogeneously distributed radiation in a test apparatus. Furthermore, such a measuring device may be used in test apparatues having more than one radiation source. Also, it is advantageous if, in addition to radiation dosage integrated over time and/or specified spectral ranges, it is possible to obtain a reading of instantaneous radiation intensity.

If spectral dispersion in the radiation detector is produced by means of an element which is resistant to radiation (such as, e.g., a prism or a grating), constancy of sensitivity and spectral constancy of the radiation measuring device are assured. Preferred, in particular, is a reflection grating. By the provision of one or several radiation detectors which are adjustable, it is assured that radiation which is optimal for a test is in fact measure. Substantial advantages, especially with respect to testing methodology, are realized if a second or additional radiation detector is used to measure incident radiation in a spectral region which differs from the region which is optimal for testing a binder or a pigment. For example, a second or additional detector may be tuned to a spectral region which is defined by a recognized standard. Similarly, a measured value may be related to other values of the spectral region, whereby, in particular, connection may be made to other test series. Furthermore, changes of the intensity in different spectral regions can provide information about aging of the radiation source. The photodetectors are chosen sensitive preferably to wavelengths in the range of 300 nm to 700 nm and preferably in the range of 300 nm to 450 nm.