ACCELERATED LIGHT FASTNESS TEST METHOD

This invention relates to a method of regulating the temperature of the surface of a sample in a light fastness test machine for conducting an accelerated light fastness test, i.e. a test for determining the deterioration of a paint film, or a material such as fiber or plastic, or any product when exposed to sunlight.

BACKGROUND OF THE INVENTION

The purpose of an accelerated light fastness test is to reproduce in a laboratory in a short period of time the conditions under which a sample is deteriorated outdoors by the synergetic effect of sunlight and solar heat, and accurately estimate the lifetime of the sample. To achieve this purpose, a test method of irradiating a sample with light at a predetermined light intensity from a light source provided in a test chamber and having a spectral distribution similar to that of sunlight, and maintaining the temperature of the sample at a predetermined temperature has been employed.

FIG. 6 is a schematic sectional side elevation of a conventional accelerated light fastness test machine 7 in which an example of such a method is used. This apparatus is provided in a test chamber 8 with a xenon lamp 5 as a light source for emitting light of a predetermined intensity, and with a circular sample holder frame 4 adapted to be rotated around the light source 5. Sample holders 1' on which samples 2 are mounted, and black panel thermometers 6 for ascertaining the test temperature are supported on this sample holder frame 4. Outside air is introduced into the test chamber 8 by a blower 9, the air being circulated therein and discharged therefrom to make the temperature distribution in the test chamber 8 and the surface temperatures of the samples 2 and black panel thermometers 6 uniform. The rate of introduction of the outside air and the rate of discharge of the air in the test chamber 8 are regulated by suitably displacing a damper 10 in accordance with the output from a temperature sensor (not shown) provided in the test chamber 8, and the outside air is heated as necessary by a heater 11.

The surface temperature of the samples is influenced by the radiant heat from the light source 5, the temperature of the air in the test chamber 8, the material and color of the samples and the heat radiated from the surfaces of the samples, and it is difficult to maintain the temperature of the surfaces of all the samples 2 at a predetermined level during a deterioration test carried out in the apparatus 7. Accordingly, the temperatures indicated on the black panel thermometers 6 are maintained at a predetermined level, and this temperature is used as the test temperature, this indicated temperature being controlled so as to be constant by regulating the temperature of the air circulated in the test chamber 8. Therefore, in the case where the samples consist of a material the surface temperature of which increases abnormally under conditions of practical use thereof, or a material the surface of which is liable to be influenced by wind and deformed, it is difficult to easily reproduce the condition of practical use of the material in such an apparatus.

When the light fastness of a raised fiber, or a laminated compound material, such as a urethane-lined fiber or a urethane-lined vinyl, which are used as an interior finishing material for, for example, an automobile, is tested by using a conventional accelerated light fastness test machine, the deteriorated condition of the material after the accelerated test differs from the condition of the same material after a period of practical use, and test results which correlate well with the results of the practical use of the material cannot be obtained in some cases.

The above described conventional apparatus is constructed so that the temperature in the test chamber is maintained at a constant level at all times by introducing the outside air into the test chamber and circulating the outside air therein so as to maintain the temperature of the surfaces of the black panel thermometers at a predetermined level as described above. Accordingly, heat is removed from the surfaces of the samples by this introduced and circulated air, so that the temperature of the surfaces of the samples does not increase to a level which is no lower than a certain predetermined desired level. Therefore, the samples generally have a temperature gradient in which the inner portions thereof have a temperature higher than that of the surface portions thereof. On the other hand, in the conditions of practical use of this material, for example, when the material receives direct sunlight in a closed automobile, the radiation of heat from the material does not proceed sufficiently. As a result, the temperature of the material increases, and the surface temperature thereof becomes high. Accordingly, the material has a temperature gradient in which the material at a greater depth from the surface has a lower temperature. Such a temperature gradient difference is noticeable, especially, in the above-described laminated compound materials. It has been ascertained that this constitutes the main cause of the difference between the deteriorated condition of the material after a period of practical use and the deteriorated condition of the same material which has been subjected to an accelerated light fastness test. In the case of a sample the surface of which is covered with soft, raised, elongated fibers, the fibers on the surface of the material lean over and then fall due to the temperature regulating outside air introduced into and circulated in the test chamber during an accelerated light fastness test, so that the material receives the radiated light on the side surfaces of the fibers. This necessarily causes the deteriorated condition of the tested material to be different from that of the same material after a period of practical use.

The condition under which the radiated light is received and the temperature condition of a sample having a special shape and a sample of a laminated compound material are thus basically different from the conditions for the same materials in an accelerated light fastness test. It has been ascertained that this is a cause of the failure to obtain deterioration test results which correlate well with the deteriorated condition of the same material after it has been in use for a time.

OBJECT AND BRIEF SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an improved accelerated light fastness test method for use in testing interior finishing material for vehicles, buildings and general window-surrounding surfaces, which method overcomes the problems described above.

To this end the method of the invention, in order to prevent the temperature regulating air, which is introduced into and circulated in a test chamber, from flow-