
**Plastics — Method of controlled
acceleration of laboratory weathering
by increased irradiance**

*Plastiques — Méthode d'accélération contrôlée du vieillissement en
laboratoire par irradiance accrue*

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Foreword

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The committee responsible for this document is ISO/TC 61, *Plastics*, Subcommittee SC 6, *Ageing, chemical and environmental resistance*.

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Introduction

A realization of the acceleration of laboratory weathering under controlled conditions is an essential requirement for delivering reliable and fast prediction of material durability. In this connection, the correlation to real use aging behaviour is being checked constantly.

The fundamental parameters of a weathering test are simulated solar radiation, heat and moisture. The induced change in the material properties, among other things, is determined by the irradiance level and relative spectral irradiance of simulated solar radiation incident on the material surface during the test, the surface temperature, and the level of moisture. An increase in some well-known weather parameters, continuously monitored outdoors, offers opportunities to speed up the weathering process outdoors and in the laboratory. Since 1967, acceleration of outdoor weathering with instruments for intensified weathering using concentrated solar radiation (according to ISO 877-3) became a common practice. By concentrating the natural solar radiation with Fresnel mirrors, irradiances of five to six times higher than the maximum natural level has been reached. Already in 1996, a screening procedure with very high irradiances for dyed textiles were developed which enabled the reduction of the test duration for lightfastness grades from five days to seven days to two and a half days.^[5]

However, the applicability of an increased irradiance for deterministic acceleration of weathering without a specific knowledge of material properties requires that the degradation of material (at constant temperature and moisture conditions) has to be dependent on the applied radiant exposure only, irrespective of the irradiance level and resulting exposure duration used during the test. For some materials fulfilling this criterion, the acceleration of weathering has been demonstrated successfully.^{[6][7][8][9]} This criterion is not always fulfilled since an increase in the irradiance might not always produce the expected increase in the weathering acceleration due to possible and a priori unknown to the operator nonlinear dependence of the photochemical processes on the irradiance level. Moreover, the overall material degradation might be strongly affected by the other weather parameters which can be modified due to the increased irradiance.

There are limitations in using increased irradiances. Therefore, the applicability and the limits of this weathering acceleration approach are determined by the properties of the specific material and have to be investigated systematically in each particular case. In this respect, it is of essential importance to validate an appropriate test procedure under controlled conditions in laboratory with an artificial radiation source which can provide high irradiances above the natural level with the relative spectral irradiance closely mimicking the natural solar radiation. Simultaneously, the temperature of the sample specimen surface and of the chamber air is kept constant in a wide range of irradiance level. In addition, the usual wetting and rain option have to be available.