

ACCELERATED AGING TEST

SAFE SUSTAINABLE SOLUTIONS



The accelerated aging is used to simulate the effects of aging in real time by subjecting samples to high temperatures for specific periods of time, thereby generating data faster and reducing time to market.

In parallel with accelerated aging, the manufacturer must also perform a real-time study in order to validate the data generated during the accelerated aging process.

Accelerated aging means that more heat, moisture, oxygen, sunlight, vibration, etc., can be used to accelerate the normal aging process of objects. It is often used to determine the long-term effects of expected stress levels over a shorter period of time by standard testing methods controlled in a laboratory. It is used to estimate the useful life of a product or the expiration date if there is no real-life information available.

Accelerated aging techniques are defined on the basis that the chemical, physical and microbiological reactions involved in the deterioration of materials depend on storage conditions. For some materials, there are ISO standards or scientific reference papers.

For polymeric materials, it is customary to refer to the Arrhenius equation published in EU Regulation no. 10/2011.

The available models are able to describe, with a fair amount of precision, the trend of a property of the material subjected to accelerated aging since, as mentioned, it consists in simulating for short times the chemical-physical degradation that would occur for very long operating times at room temperature (20/25°C) much lower than the treatment times (60/80/100°C).

Analytically, Arrhenius' law is:

$$t_2 = t_1 \cdot e^{9627 \cdot \left(\frac{1}{T_2} - \frac{1}{T_1} \right)}$$

where:

t1 = Contact time

t2 = Test time

T1 = contact temperature in Kelvin. For storage at room temperature 298 K (25°C). For refrigerated and frozen conditions 278 K (5°C).

T2 = test temperature in Kelvin.

Relative humidity (RH) is not a factor in the Arrhenius equation. However, the relative humidity should be kept below 20% so that the material is not damaged.



OUR SOLUTION



The need to evaluate how a material or an artifact will behave after a certain period of time under certain environmental conditions is one of the most felt problems in the field of materials science. All variables are important: knowledge of the material, estimation of conditions of use over time, study of accelerated aging conditions

It is often necessary to refer to methodologies consolidated over time and standardized for the various application sectors because of the very large number of variables; In fact, the regulations allow the aging conditions to be fixed in a defined way and in order to be able to replicate the measurements independently of the operator and the laboratory.

During the design of the test plan, different storage conditions and consequent accelerated aging are hypothesized, with the aim of being able to apply predictive mathematical models of chemical-physical effects based on the Arrhenius equation.

Other factors are determinants; We mention just a few:

- the definition of objectives must be as clear as possible;
- the knowledge of the possible variables to which the material will be subject IN REALITY;
- the way samples are placed in aging machines;
- knowledge of the chemistry of material degradation;
- knowledge of any possible stabilizations for the material in question;
- the way(s) in which the degradation of the material will be assessed.



It is important to keep in mind that accelerated tests often take a long time: the preliminary discussion of the objectives and the correct design of the tests are just as important as the test itself.

Aging tests are performed by placing samples inside special stoves supplied to the laboratory; they simulate the effects of aging, subjecting the samples to high temperatures and humidity for specific periods of time according to the Arrhenius equation.

In parallel with accelerated aging, the laboratory must also perform a real-time study with the aim of validating the data generated during the accelerated aging process.

The Laboratory Management

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