1. **Purpose**

There is a difficulty to predict the durability of materials because of the need to consider the many conditions needed to estimate its durability. Yet, we have to know a material's durability to use it. Degradation of materials is one of chemical reaction, so we can know its durability from heat degradation. Generally Arrhenius's method is used to estimate the durability of materials.

The relationship between speed of chemical reaction and temperature is shown as follows by S. A. Arrhenius in 1889.

$K = A \exp (-Ea/RT)$ ………. (1)

K: velocity constant
R: gas constant
T: absolute temperature
A: frequency factor
Ea: activation energy

To estimate materials durability, expression (1) leads expression (2).

$\ln (t) = Ea/(RT) + const.$ ………. (2)

t: hours

Expression (2) means, logarithm of time "t" proportional to (1/T). So, promoted test results at high temperature can estimate life of materials at normal condition. We choose half-life of material's elongation data to estimate durability of ADEKA ULTRASEAL® MC-Series.
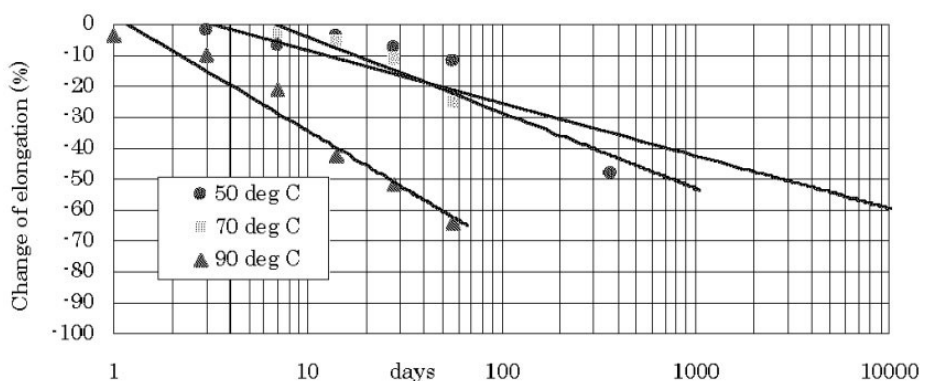
2. **Promoted Degradation Test**

Testing condition is shown at table 1.

Table 1) Testing Condition

Test Item	Elongation
Temperature	50, 70 and 90 degrees C
Predict Method	Half-life of elongation
Testing Method	JIS K 6251

Result—Fig. 1) Relationship between change of elongation and days

We can read half-life of elongation from Fig. 1) as follows, Expression (3) - (5) show approximate expression of change of elongation and days data.

$y = -7.3658 \ln (x) + 8.4807$ ………. (3)
$y = -10.674 \ln (x) + 20.74$ ………. (4)
$y = -16.119 \ln (x) + 2.7283$ ………. (5)

y: change of elongation
x: days

Temperature—(Deg C) (Deg F) (K)	Days	t (hrs)
90/194/363	26	632
70/158/343	755	18,131
50/122/323	2,806	67,342

3. **Predict of Material's Life**

Expression (2) and Table 1 show relationship of ln (t) and 1/T as follows.

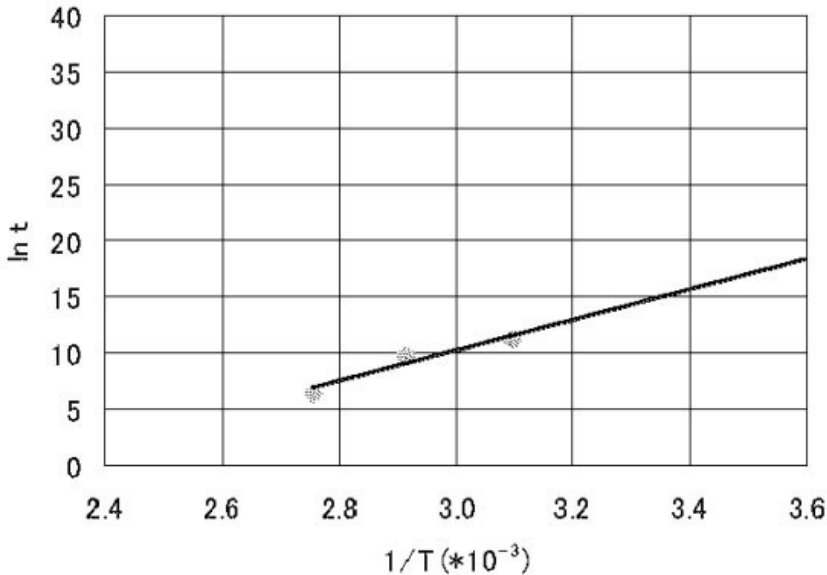

Fig. 2) Relationship between ln (t) and (1/T)

$$\ln (t) = 13.552 * (1/T) * 10^3 - 30.476 \ldots\ldots (6)$$

Expression (6) leads durability of ADEKA ULTRASEAL® MC-Series at 20 - 30 degrees C as follows.

Table 2) Durability of ADEKA ULTRASEAL® MC-Series

Temperature—(Deg C) (Deg F) (K)	Predicted Durability (years)
20/68/293	811
25/77/298	373
30/86/303	176

This predict method results degradation time at controlled conditions so the data does not estimate durability at actual condition. Materials are used in many kinds of conditions so its durability is different in many cases. But this durability data is useful to know that ADEKA ULTRASEAL® MC-Series has good degradation resistance ability.