ADEKA ULTRASEAL®

P-201 Durability Data

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).

$\ln(t) = Ea/(RT) + \text{const.}$ ………. (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® (CURED TYPE).

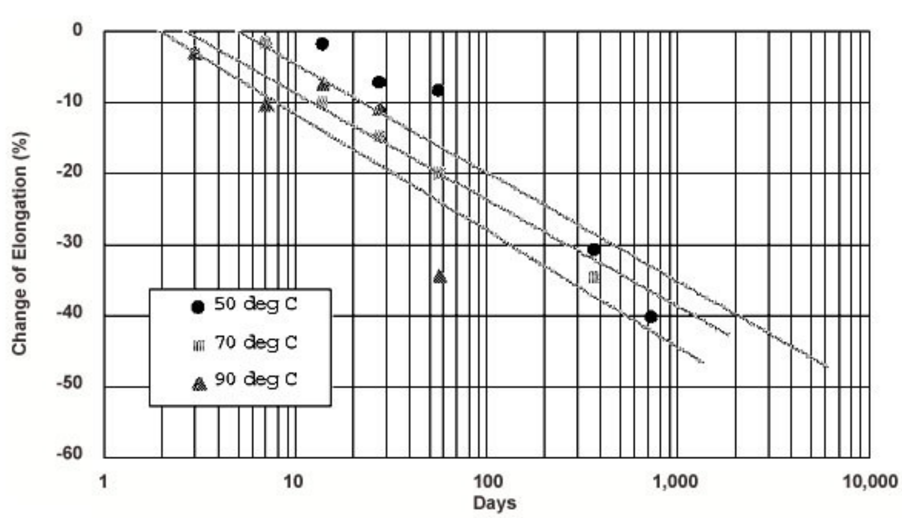
2. **Promoted Degradation Test**

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.

$y = -6.6262 \ln(x) + 10.69$ ………. (3)
$y = -6.5231 \ln(x) + 6.4195$………. (4)
$y = -7.1223 \ln(x) + 4.826$ ………. (5)

y: change of elongation
x: days

Temperature—(Deg C) (Deg F) (K)	Days	t (hrs)
90/194/363	2,203	52,884
70/158/343	5,705	136,932
50/122/323	9,370	224,886

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

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

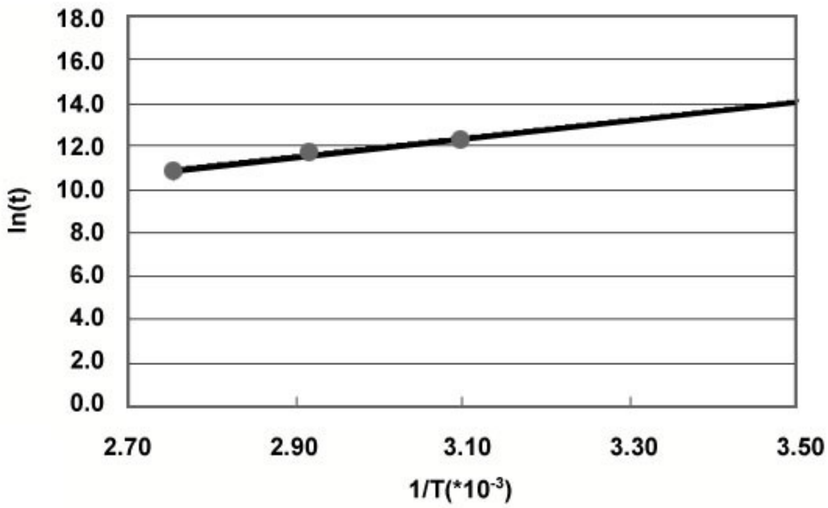


Fig. 2) Relationship between ln (t) and (1/T)

ln (t) = 4.4122 * (1/T) * 10^3 - 0.633 ………. (6)

Expression (6) leads durability of ADEKA ULTRASEAL® P-201 at 20 - 30 degrees C as follows.

Table 2) Durability of ADEKA ULTRASEAL® P-201

Temperature—(Deg C) (Deg F) (K)	Predicted Durability (years)
20/68/293	106
25/77/298	83
30/86/303	66

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® P-201 has good degradation resistance ability.