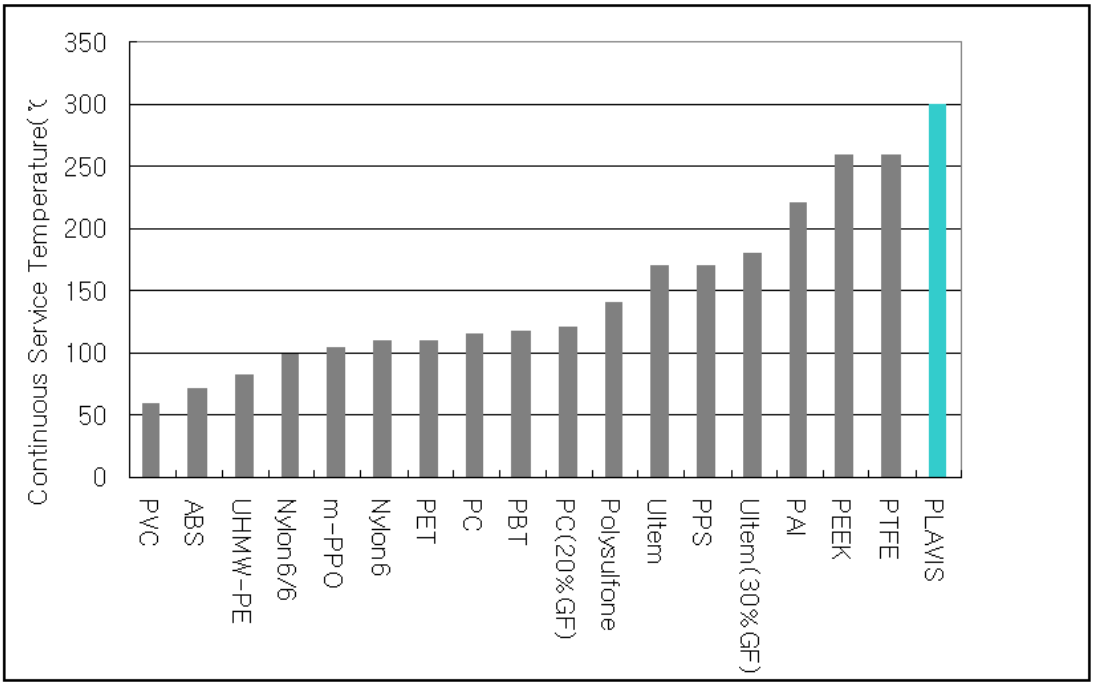
Thermal Property of PLAVIS

1. Relationship between Thermal Property and Temperature

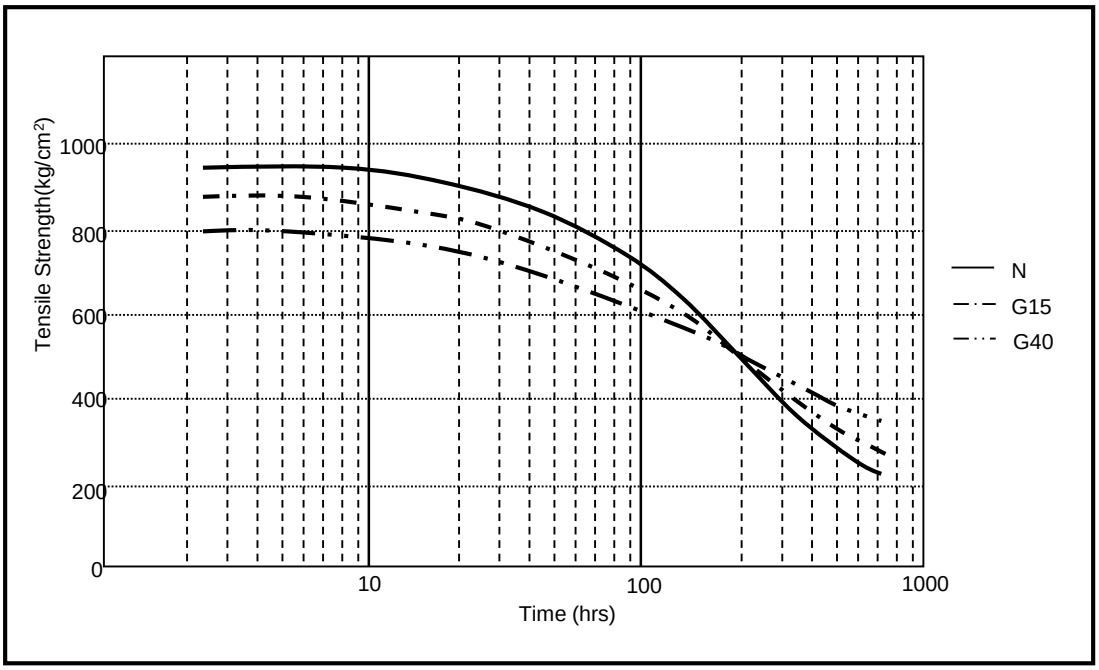
PLAVIS polyimide does not melt and has no glass transition temperature (Tg) .PLAVIS can be used until consecutive 300℃ in air. (Figure 1)
At 370℃ in terms of time to 50% reduction in initial tensile strength.
In PLAVIS N case, it will take 200 hours, PLAVIS G15 requires about 220 hours and PLAVIS G40(40% graphite) 360 hours to reach the 50% strength level. The loss in properties with time at temperatures up to about 400 ℃ is due almost entirely to oxidative degradation. At temperatures up to at least 400 ℃ , PLAVIS will perform in inert environments such as nitrogen or vacuum.

<Table 1> PLAVIS thermal property

Glass Transition Temperature(Tg)	N.A
HDT (18.6kg/cm^2)	360℃
Thermal decomposition temperature(℃, in air)	614℃
Thermal 50wt% reduction time(min, in air)	239min



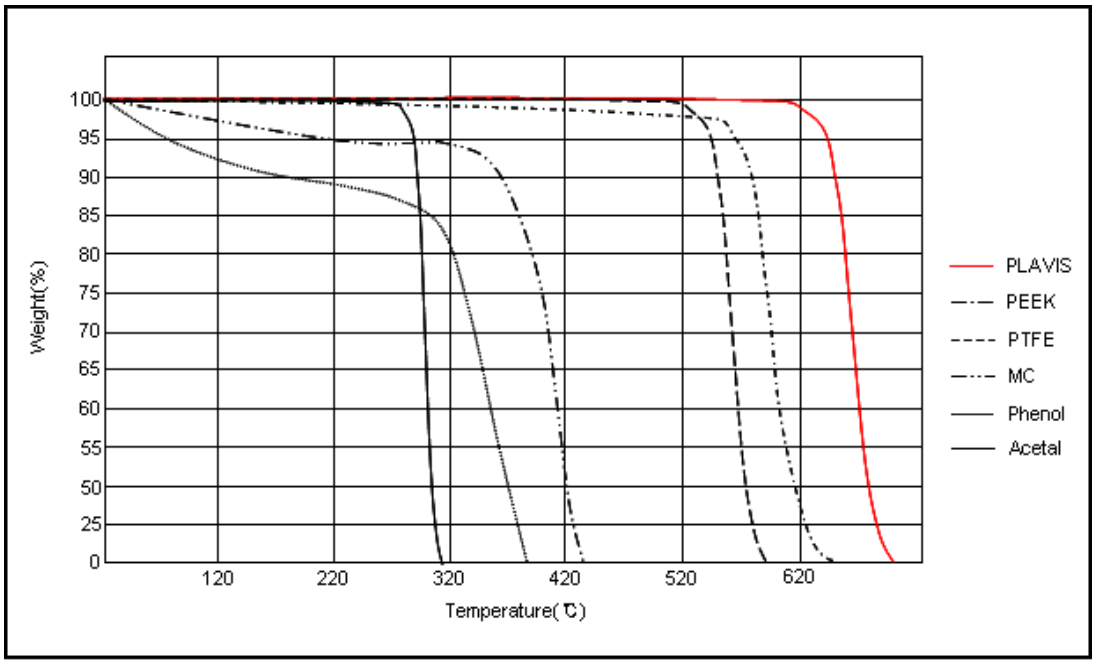
< Figure1 > Continuous Service Temperature in air per ASTM D-794)



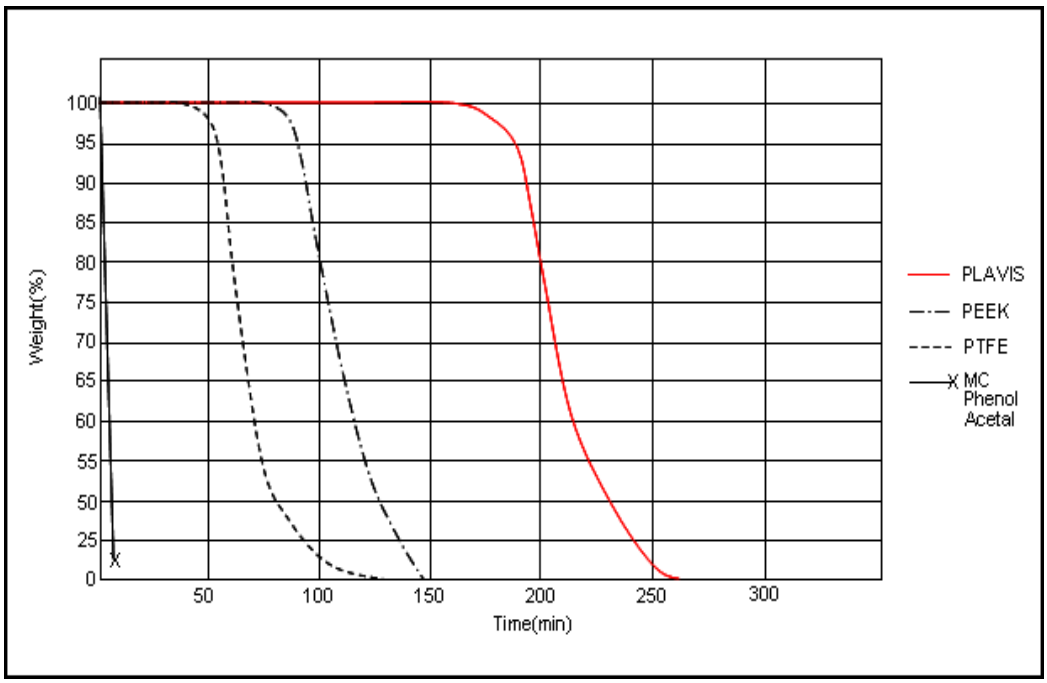
< Figure 2. > Exposure to air at elevated temperature approximate time to 50 % reduction in Tensile strength vs Temperature(370℃ in air)

PLAVIS does not melt and has no glass transition temperature (Tg) or softening point as measured by the usual methods, strength and modulus decrease with temperature in a nearly linear manner. This contrasts to the usual engineering thermoplastic which shows a large decrease in these properties as the Tg is approached.

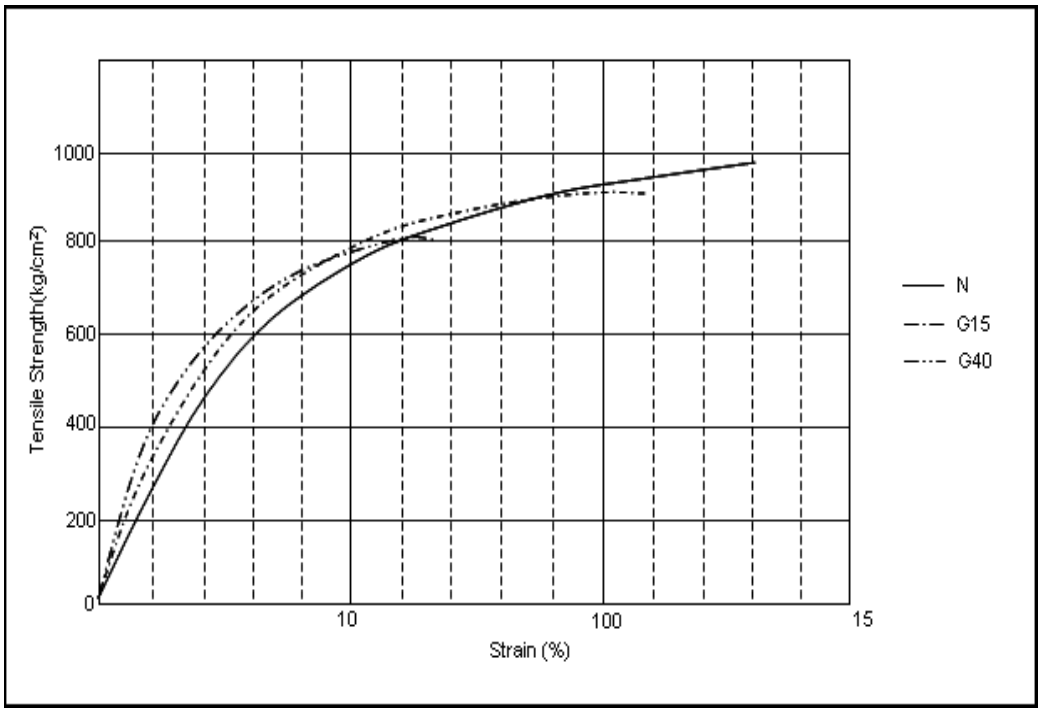
The upper use temperature of PLAVIS is limited by its rate of degradation, not by a softening point where it would lose its load-carrying capability. Parts may be used continuously in air at 480 ℃ and for short excursions to as high as 614 ℃.



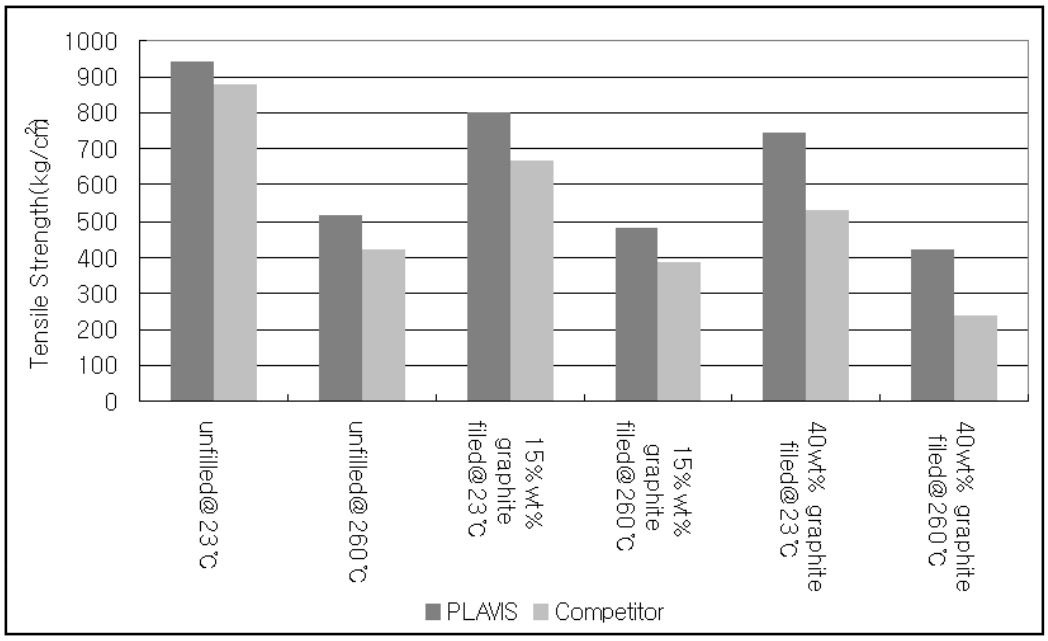
<Figure 3. >Thermal Decomposition temperature in air



< Figure 4. > Thermal 50wt% reduction time in air



< Figure 5. > PLAVIS typical Stress-Strain curves in tension [ASTM-E8, 260℃]

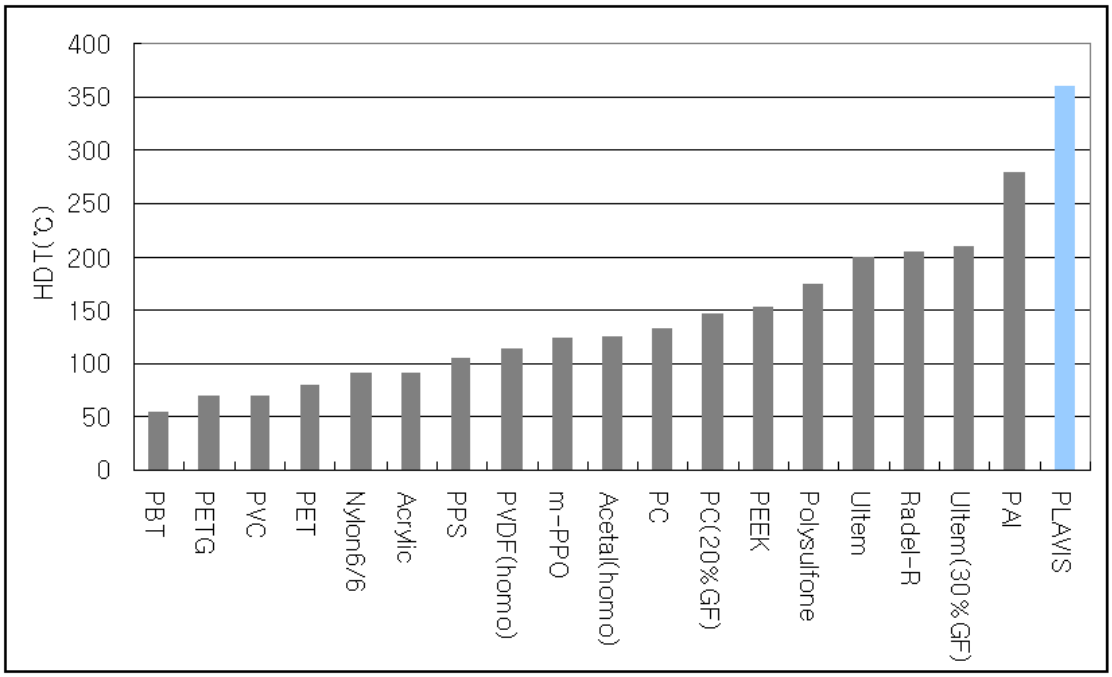


< Figure 6. > Relation between typical tensile strength and Temperature ASTM-D1708

The reason of having a outstanding thermal property is that PLAVIS has high HDT compared with other engineering plastics like PAI, PEI, PEEK. These plastics are week of high temperature because they melt and has glass transition temperature (Tg) or softening point.

Over Tm or Tg, their form will be collapsed so they can not performance at high temperature.

The high HDT of PLAVIS can prove that Polyimide is only a high molecular substance at high temerature.(Figure 7).



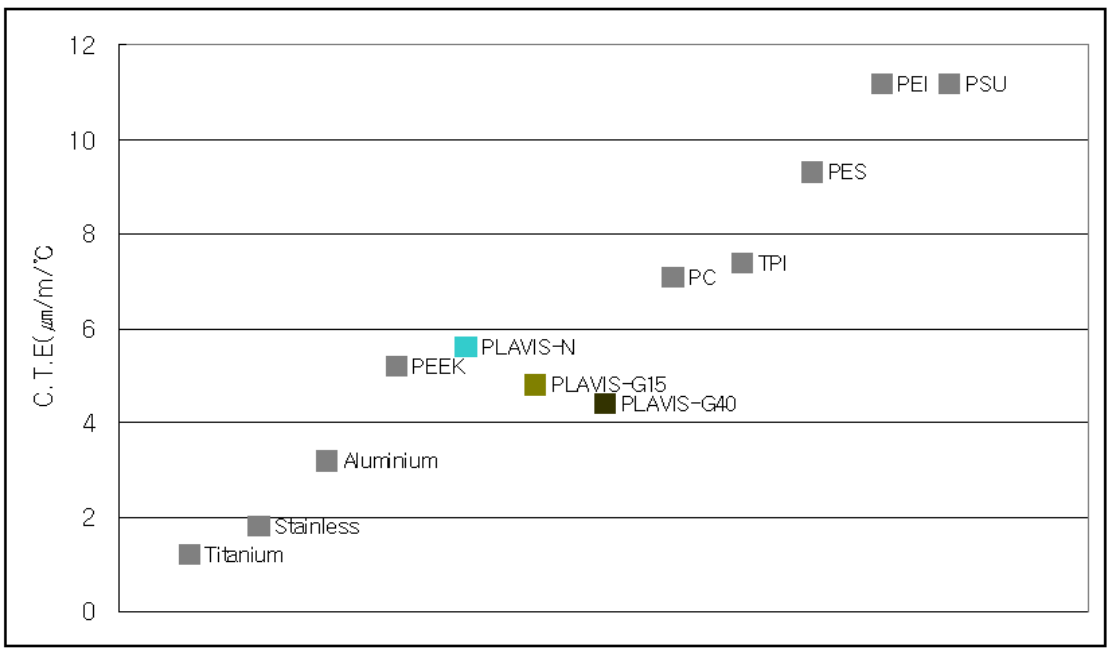
< Figure 7. > PLAVIS HDT comparison with other engineering plastic[@264psi]

2. The Property of Thermal Expansion

Dimension of PLAVIS can also changed by temperature like other plastics, the extent of thermal expansion depends on the grade of PLAVIS.
Table 2 shows thermal expansion coefficient of typical PLAVIS.
The addition of graphite filler reduces thermal expansion.
therefore PLAVIS G15 and G40 offer a lower expansion than unfilled PLAVIS N.
The coefficient of thermal expansion of PLAVIS G40 approaches that of aluminum.

< Table 2> PLAVIS average coefficient of Thermal expansion

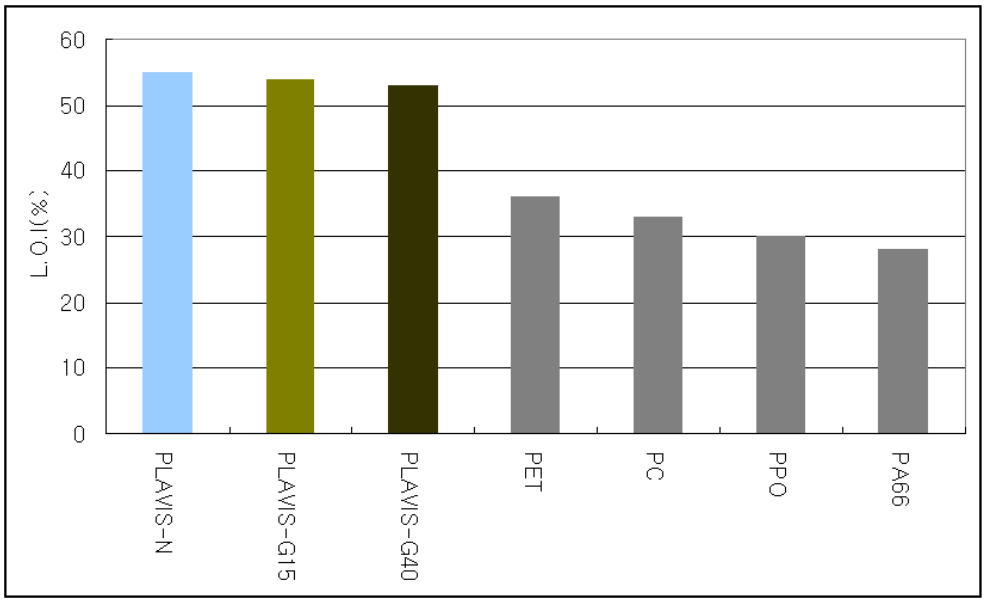
Grade	PLAVIS-N	PLAVIS-G15	PLAVIS-G40
Coefficient of Thermal expansion(㎛/m/℃)	5.6	4.8	4.4



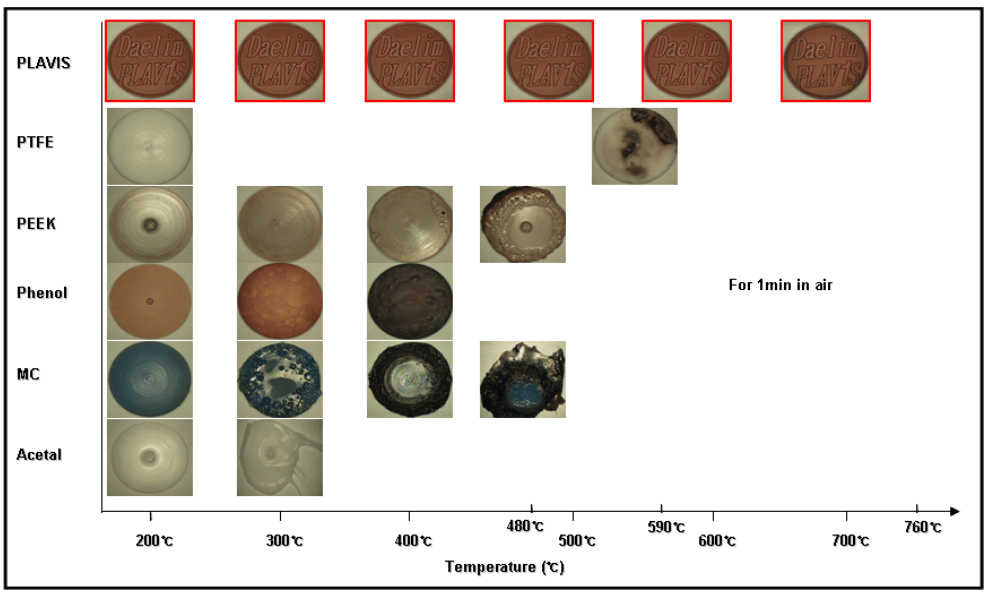
< Figure 7.> correlation of coefficient of thermal expansion[23~300℃]

3. Combustibility

PLAVIS does not burn with no spark in the air. Limitation oxygen measure is the minimum oxygen amoun t to burn any material continuously.
Below are Limitation oxygen measure of PLAVIS.
PLAVIS-N: 55%, PLAVIS-G15: 54.15%, PLAVIS-G40: 53.7%.
In other plastics's case, omnidirectional polyester 36%, polycarbonate 33%, PPO 30%, and Nylon 66 28%.
According to above data, PLAVIS has more higher than other engineering plastics in Limitation oxygen m easure so PLAVIS can not burn easily.



< Figure 8> Comparision with other Engineering Plastics in Limitation oxygen measure



< Figure 9> Exposure test of PLAVIS-N for 1 min in air