

A Characteristic of Dendrimer-acrylate

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Abstract

We established composition of Dendrimer-acrylate(Hyperbranched-polymer).

We examined behavior of the ultraviolet rays hardening.

In comparison with the general acrylic monomer, the increase of the cure rate, the decrease of the oxygen obstruction, decrease of the hardening shrinkage were confirmed. In addition, the provided film understood that I was superior in hardness and the softness.

1. Introduction

The development of acrylic materials developed with establishment of the ultraviolet rays hardening rapidly from about 1970. The ultraviolet rays hardening is the technology that is important in electronic materials now. Application of the ultraviolet rays hardening is coating, the adhesion, sealing, and patterning. The ultraviolet rays hardening system by acrylic materials has good and bad points to show as follows.

good points	bad points
Hardening is fast Film is transparent Cost is low etc	Shrinkage is high Oxygen obstruction Weather ability is low

TABLE 1.

Good and bad points of UV Hardening.

Dendric polymer is classified roughly into Dendrimer and Hyperbranched polymer.

The molecular weight distribution of Dendrimer is very small ,near to 1.0.

But there is the molecular weight distribution of Hyperbranched polymer in the range of 1.5-2.0

In this presentation, we will speak about dendrimer-acrylate and Hyperbranched polymer-acrylate by the name of dendrimer-acrylate.

Dendrimer-acrylate is the superior acrylic oligomer which can improve bad points of UV hardening.

2. Composition of DENDRIMER-ACRYLATE

V-1000 : We composed dendrimer of the polyol from a hydroxyl and carboxyl molecule.

I made a hydroxyl group of the polyol ester with acrylic acid and composed dendrimer-acrylate.



FIGURE.1

Dendrimer-acrylate 「V-1000」

STAR-501 : We combined DPHA and a thiol material into the dendrimer-acrylate that has structure of mesh and spherically

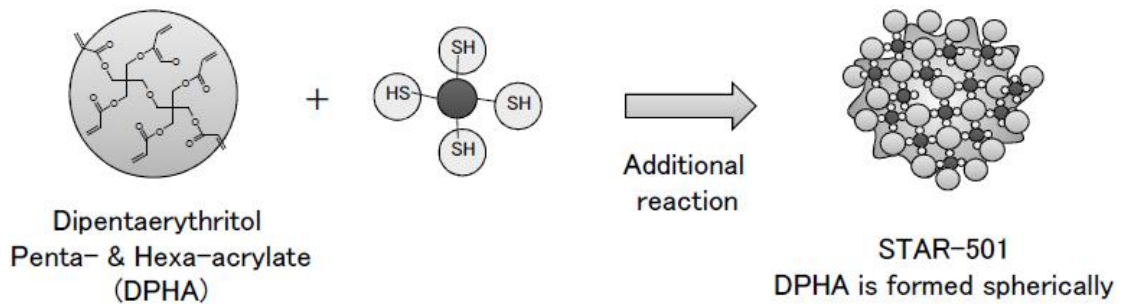


FIGURE.2

Dendrimer-acrylate 「STAR-501」

3. A RESULT OF UV-HARDENING OF STAR-501

In comparison with the linear polymer with molecular weight at the same level, it was confirmed that STAR-501 had low viscosity.

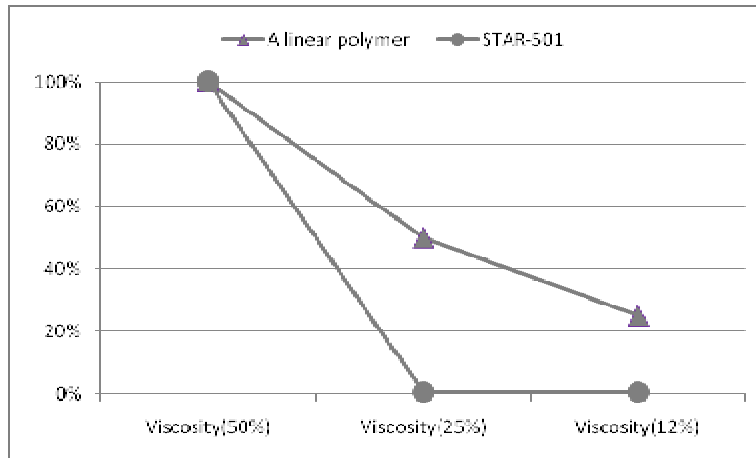


FIGURE 3.

Comparison of the viscosity behavior.

I combined initial-agent of UV hardening with STAR-501 or DPHA, and we made the film of the same film thickness and exposed .We observed the disappearance speed of the double bond by IR spectrum.

We obtained results that the double bond of STAR-501 decreased earlier than double bond of DPHA.

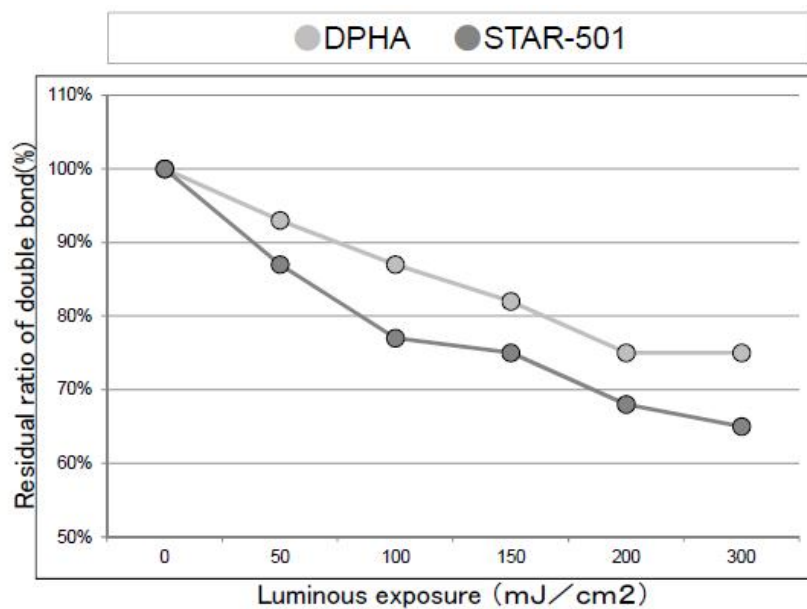


FIGURE 4.

The comparison of the cure rate.(The ratio of the double bond with IR)

We observed the exposure got enough hardening strength ,with DPHA and STAR-501.
 If a film thickness becomes thin, we make film hardening with more exposures.
 Even if a film thickness of STAR-501 became thin, we were able to strengthen it with exposures less than DPHA. In fact,STAR-501 hardens with little energy when film thickness is thin,and is not affected by oxygen inhibition.

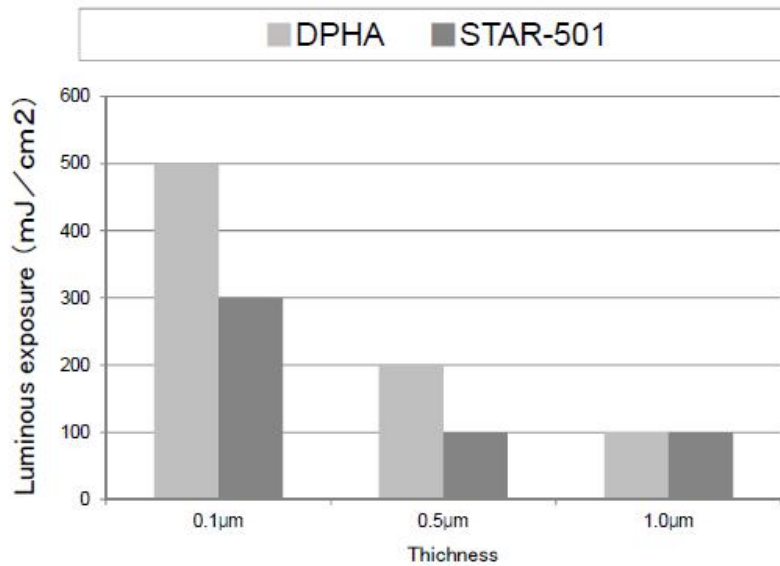


FIGURE 5.
 The comparison of oxygen obstructions.
 (The exposure that is necessary for hardening)

With DPHA and STAR-501,We observed the pencil hardness (JIS) and adhesive.
 In the science of the UV hardening , pencil hardness and adhesive cannot increase together in any cases.but STAR-501 was increased in pencil hardness and adhesive.
 STAR-501 is a particle of the nanosize. We divined that closs-linked of “in the particle” is different from closs-linked of “between the particles” very much, so there are coarseness and minuteness in a closs-linked network

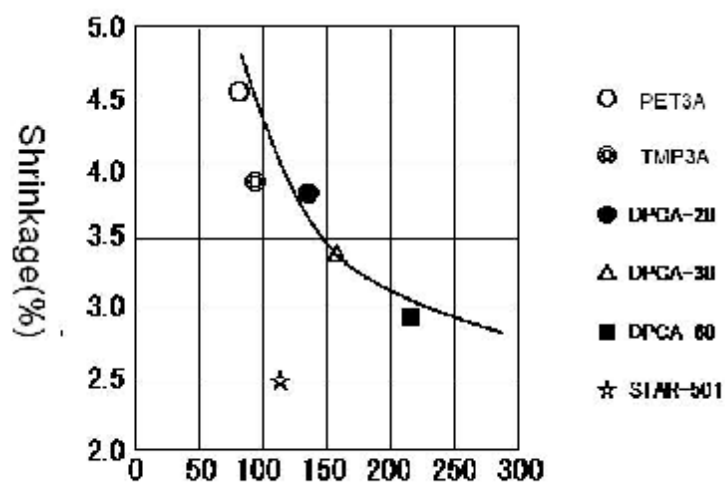
Film Performance		DPHA	STAR-501
Optics	Reflectivity	5.9	6.0
	Transmittance	90	89
	Haze	0.8	0.8
Stress	Hardness	2H	3H
	Adhesive	40/100	100/100
	Curly	NG	OK
	Steel wool (200g)	NG	OK

TABLE 2.

The pencil hardness and adhesive.

With V-1000 and STAR-501, we measured the volume shrinkage by the hardening. we made the volume shrinkage and the graph of the double bond chemical equivalent as comparison contrast in many sensuality monomer, two sensuality monomers, a single sensuality monomer (a molecular weight difference).

Dendrimer-acrylate has a smaller hardening shrinkage than a normal acrylic monomer.



A chemical equivalent of the acrylic (g/eq)

FIGURE 6.

The comparison of hardening shrinkage.

4. CONCLUSIONS

Dendrimer-acrylate makes up for low hardening, shrinkage, hardness and coexistence of the flexibility bad point of the conventional acrylic monomer.

5. References

[1] WO2,008/047620