A design of low shrinkage acrylate and the mechanism of the hardening

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***Abstract*- As for the merits of the acrylic monomer, fast cure rate, high transparency, and high hardness. On the other hand, a demerit is the large shrinkage. Fortunately, we have succeeded in development the acrylate monomer MEGAm of super low shrinkage. A possible mechanism is C – O bond cleavage and polymerization occur simultaneously by UV light.**

I. Introduction

Ultraviolet light curable materials have been applied to display and optical film materials. There are many advantages, including the fast cure rate, energy saving. At the same time, there are unresolved difficulties. One of the problems is the shrinkage of the hardening. The polymerization reaction as many molecules to a molecule, the cure shrinkage occurs in the gaps with a covalent bond distance from the conversion of van der Waals distance (show Figure.1). As a way to avoid them, there is a method using polymerizable oligomer. In order to design more sophisticated materials are being sought to resolve the new approach.

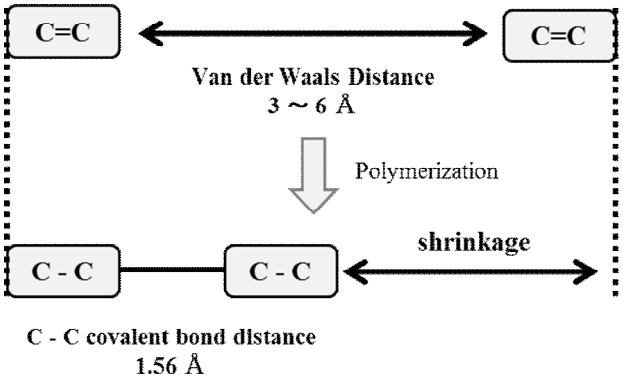


Figure.1

II. Concept

As mentioned earlier, the mechanism of curing contraction gaps in the distance that corresponds to van der Waals distance and covalent bonding. So we planned a monomer in Figure 2 is cleaved a part of the structure as well as polymerization (show Figure. 3).

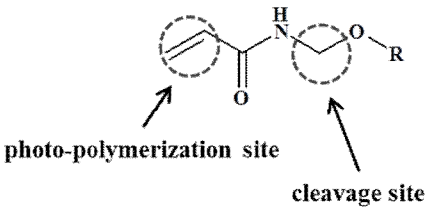


Figure. 2

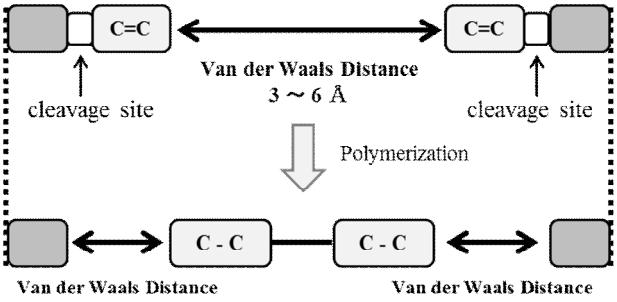


Figure.3

III. Results and discussions

A. Behavier of the cleavage with UV irradiation.

R with a portion of the polyethylene glycol backbone "MEGAm" in Figure.2 compared with the sample A was synthesized (show Figure.4) .

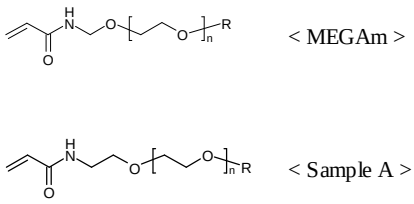
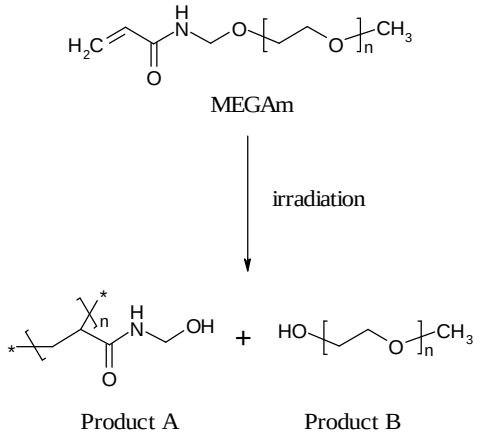


Figure.4

Photoinitiator is added to each monomer, decomposition behavior was observed in side chain with ultraviolet irradiation by high performance liquid chromatography(show scheme 1). As a result, methylene group was located between amide and ether groups (MEGAm) was found to absorb ultraviolet light and cleavage (Figure.5).

On the other hand, comparative example of the ethylene group between the amide and ether groups (Sample A) showed no degradation (Figure.5).



Scheme 1

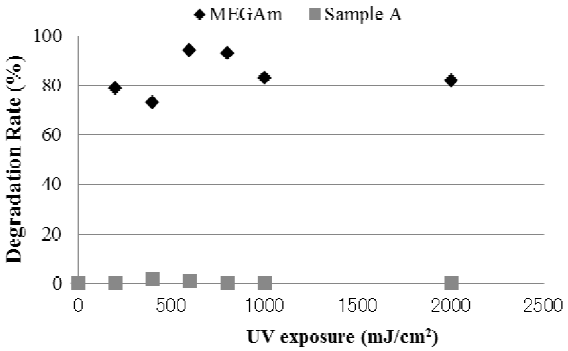


Figure.5

B. Mesurement of cure shrinkage.

Results of the measurement, the cure shrinkage of conventional monomer Sample A was 4.1%. Meanwhile, the newly developed MEGAm was 1.9%.

From these results, the cleavage site was introduced acrylic monomer, cure shrinkage was much lower than conventional monomer .

IV. Conclusions

To summarize, We have developed MEGAm show a very low cure shrinkage. A measure of the cure shrinkage was found to be nearly zero. The shrinkage is low due to the bond cleavage is the occurrence of van der Waals distance.

Here we have developed MEGAm and that applied to holographic memory and found that the media made the error rate is very low. In this presentation, and application of this material are discussed together, as incorporated into the polymer structure is decomposed parts.

Acknowledgment

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References

[1] K. Matsuoka, N. Yoshioka, and Y. Saruwatari, “Novel (meth) acrylic monomers and its manufacturing method” JP P2009-155264A

[2] K. Matsuoka, N. Yoshioka, and Y. Saruwatari, “Novel (meth) acrylic monomers and its manufacturing method” JP P2009- 263285 A