Novel Warm-Melt Type Radiation Curable Resins

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1. Introduction

Recently, warm-melt coating systems were required from the viewpoint of environmental protection. [1]

On the basis of the requirements, we have investigated the preparation of radiation curable resins which were consisted of novel urethane acrylates from polyesters using vegetable oil, and their use as warm-melt type radiation curable pressure sensitive adhesives (PSAs) described in the previous patent and paper. [2,3] In this communication, their use as elastomers are investigated.

2. Experimental

2.1. Preparation of PUA

Warm-melt type radiation curable resins (PUA) were prepared as follows. An isosyanate terminated prepolymer was prepared from polyester polyol (P) and isophorone diisocyanate(I) in the presence of 2,6-di-tert-butyl-4-methylphenol(200ppm) as anti-oxidant and dibutyl-tin dilaurate(100ppm) as catalyst, and then end capped by hydroxyethyl acrylate (A) in the presence of p-methoxyphenol (200ppm) as polymerization inhibitor. PUA consists of A-(IP)3-I-A. For the UV curing, 1.5 wt% of 4-(2-hydroxyethoxy)phenyl-(2-hydroxy-2-propyl) keton was used as photo-initiator.

The weight-average molecular weight (Mw), number-average molecular weight (Mn) and distribution (Mw/Mn) of PUA were determined by size exclusion chromatography (SEC) using standard polystyrene. The viscosity of PUA was carried out according to JIS K7301.

2.2. UV/EB curing

PUA was applied onto 38 μm-thick release PET film at 100°C to form 30 μm-thick coatings using a hot-melt coater. This film was covered with 38 μm thick release PET film. UV curing was carried out on a conveyor driven at several speeds and irradiated with a high-pressure mercury lamp (80W/cm) at a distance of 10cm. EB curing was carried out without a photo-initiator on an EB instrument. [Iwasaki electric Co., Ltd. (200k V)]. Curing speeds of UV and EB were determined by gel fraction on UV/EB irradiation..

2.3. Measurements of physical properties

The measurement of Shore A hardness and compression set was carried out according to JIS K6301. Glass transition temperature (Tg) was determined by dynamic mechanical analysis. Elongation and tensile strength of the cured resin were determined according to JIS K7311.

Measurement of VOC: Cured films were kept at 120°C for 36hrs under flowing a nitrogen gas in the oven, and the nitrogen gas which containing organic compounds was captured with a column. Organic compounds were analyzed by GC-MS.

3. Result and Discussion
Table 1  Characteristics of PUA

<table>
<thead>
<tr>
<th>Color</th>
<th>Heating Residue</th>
<th>SEC</th>
</tr>
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<tbody>
<tr>
<td>Garder</td>
<td>10 Torr, 120°C</td>
<td>Mw</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mw/Mn</td>
</tr>
<tr>
<td>1</td>
<td>99% ≤</td>
<td>3E4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1E4</td>
</tr>
<tr>
<td></td>
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<td>3</td>
</tr>
</tbody>
</table>

Fig.1. Dependence of viscosity on temperature

Fig.2 Heat stability at 100°C

In conclusion, a novel radiation curing resin was developed, and their warm-melt coating systems were established.

4. References
2. J. Ikeda, JP98330453