

Table 3. The properties of Cured *SQ* series [in the case of UV cure in combination with photo initiators].^{a)}

				<i>AC-SQ</i>		<i>MAC-SQ</i>			<i>OX-SQ</i>		
				TA-100	SI-20	TM-100	SI-20	HDM	TX-100	SI-20	HDX
Test Formulation (Parts)	<i>SQ</i> series			100	100	100	100	100 ^{b)}	90	100	90 ^{b)}
	Radical Photoinitiator ^{c)}			3	3	3	3	3	-	-	-
	Epoxy Monomer ^{d)}			-	-	-	-	-	10	1.5	10
	Cationic Photoinitiator ^{e)}			-	-	-	-	-	2	1.5	2
Evaluation Items	Unit	Measurement method	Condition of measurement								
Specific gravity	-	JIS K 0061:2001	20/20 deg-C	1.34	1.27	1.30	1.24	-	1.18	1.14	-
Curing Shrinkage	%	f)	-	8.9	8.0	7.4	7.7	-	2.6	4.6	-
Storage Modulus	Pa	DMA ^{g)}	0 deg-C	1x10 ⁹	2x10 ⁹	2x10 ⁹	3x10 ⁹	-	2x10 ⁹	1x10 ⁹	-
			150 deg-C	1x10 ⁹	8x10 ⁸	2x10 ⁹	2x10 ⁹	-	1x10 ⁹	4x10 ⁸	-
CTE ^{h)}	ppm/deg-C	TMA ⁱ⁾	30-250 deg-C	80	120	60	90	-	120	160	-
Refractive Index	-	JIS K 7142:1996	n _D ²⁰	1.51	1.49	1.50	1.49	1.49 ^{j)}	1.49	1.47	1.49 ^{j)}
Water absorption Coefficient	%	JIS K 7209:2000 ^{k)}	Method A	1.09	1.02	0.99	0.72	-	0.24	0.16	-
			Method B	1.42	0.97	1.12	0.67	-	0.45	0.28	-
<i>T</i> _{d5} ^{l)}	deg-C	TG-DTA ^{m)}	in Air	360	340	370	340	300	330 ⁿ⁾	330	280
			in N ₂	390	390	400	400	380	400 ⁿ⁾	390	300

Notes for Table 3.

a) Curing Conditions of *SQ*'s except MAC-*SQ* HDM and OX-*SQ* HDX;

- Light source: High pressure Hg lamp, 60 W/cm.
- Lamp height: 30 cm.
- Light irradiation time: 10 minutes.
- Atmosphere: Air.

Curing Conditions of MAC-*SQ* HDM and OX-*SQ* HDX;

- Light source: High pressure Hg lamp, 80 W/cm.
- Lamp height: 10 cm.
- UV dose energy: 210 mJ/cm² per 1 pass.
- Number of exposure: 15.
- Atmosphere: Air.

b) As a solid.

c) Omnirad 1173 (IGM Resins B.V.).

d) CELLOXIDE 2021P (Daicel Corporation).

e) PHOTO INITIATOR 2074 (Solvay Japan, Ltd.).

f) Calculated by the following formula:

$$CS = \frac{SGr - SGf}{SGr} \times 100$$

CS: Curing Shrinkage.

SGr: Specific gravity of cured resin.

SGf: Specific gravity of formulation.

g) DMA: Dynamic Mechanical Analysis.

h) CTE: Coefficient of Thermal Expansion.

i) TMA: Thermomechanical Analysis.

j) Measured by the Prism Coupler.

k) Dimensions of Test specimen: 100 mm x 100 mm x 2 mm.

Method A: Submerged in 23 deg-C water for 24 h.

Method B: Submerged in boiling water for 1 h.

l) T_{d5} : 5% weight loss temperature.

m) TG-DTA: Thermo Gravimeter and Differential Thermal Analysis

Heating rate: 20 deg-C/min.

n) Instead of Omnirad 1173, WPI-113 (FUJIFILM Wako Pure Chemical Corporation) was used for preparation of TG-DTA specimens.