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APPENDICES

APPENDIX A Temperature profiles of colored PMMA sheets with 0.15% AIBN

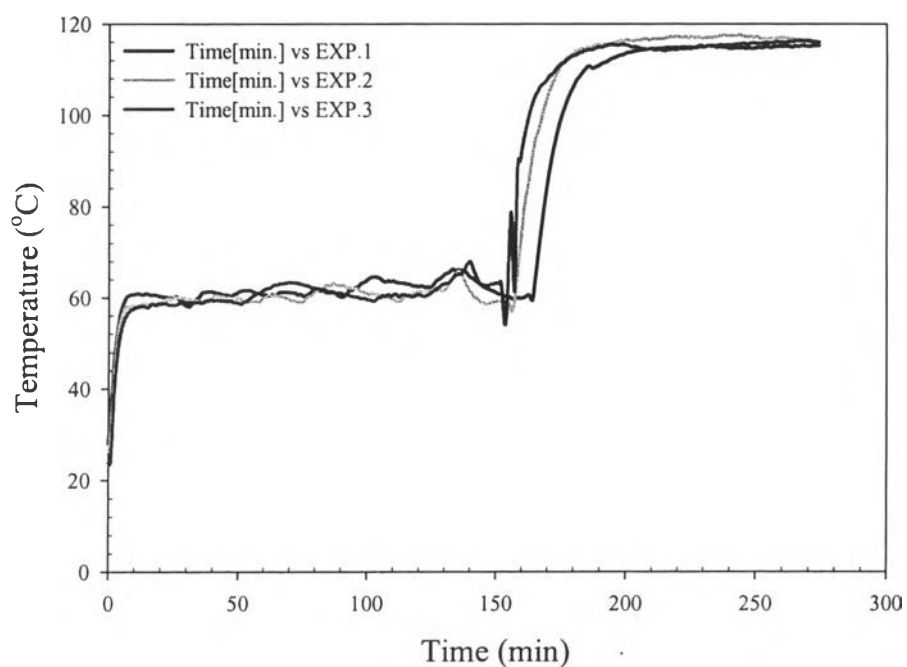


Figure A1 Temperature profiles of transparent sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

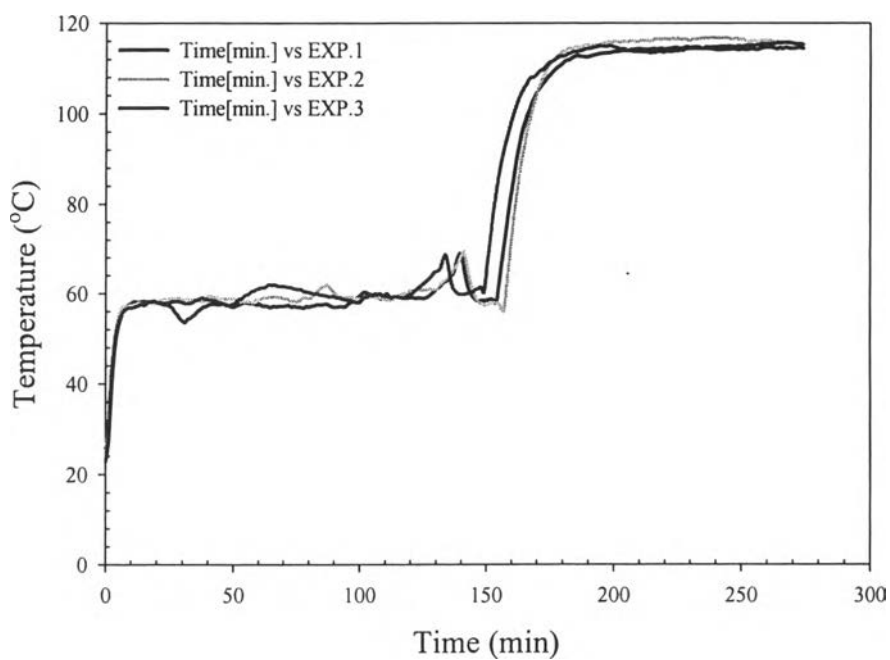


Figure A2 Temperature profiles of P-018 sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

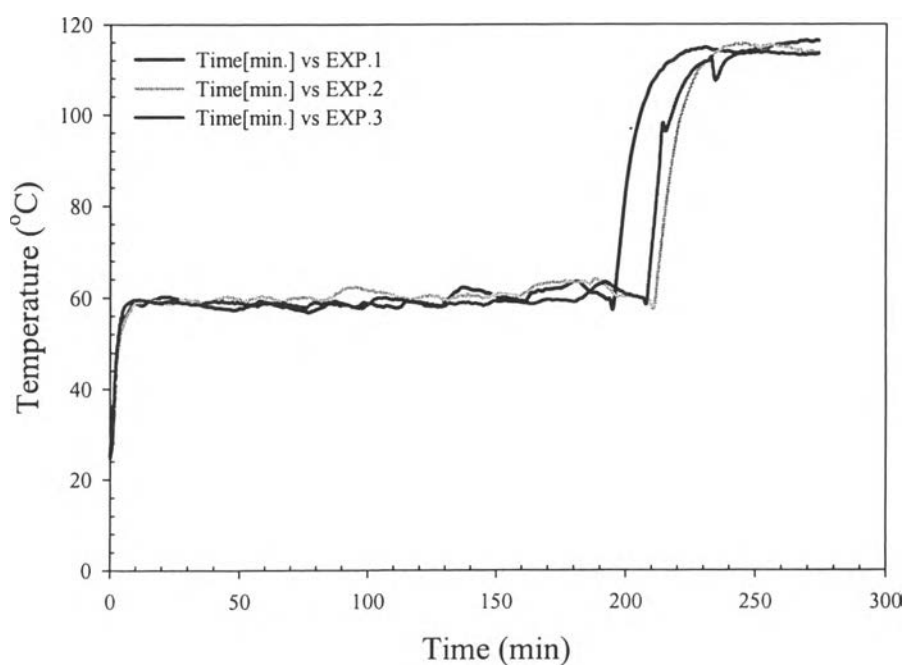


Figure A3 Temperature profiles of P-102 sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

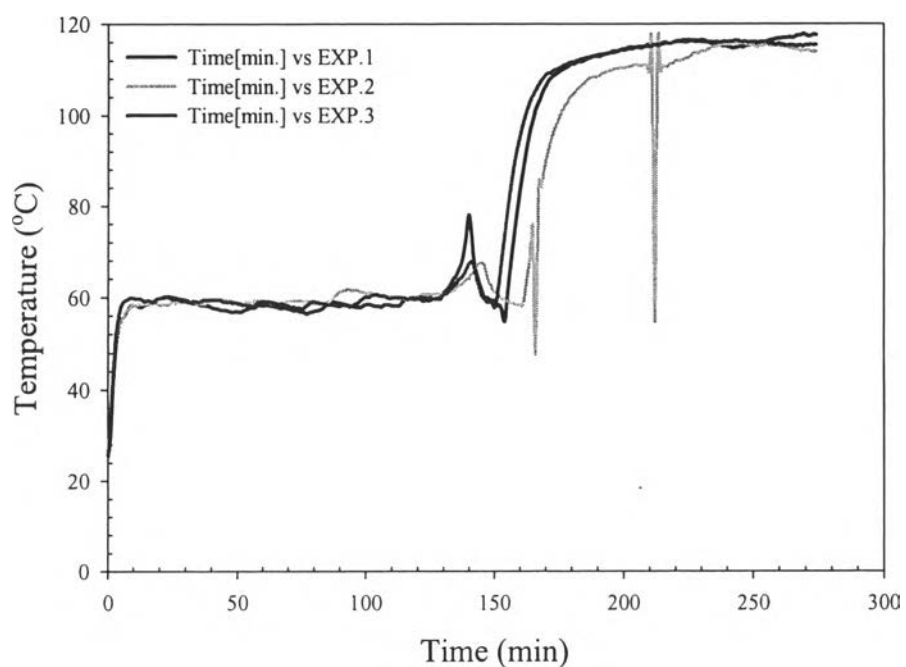


Figure A4 Temperature profiles of P-115 sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

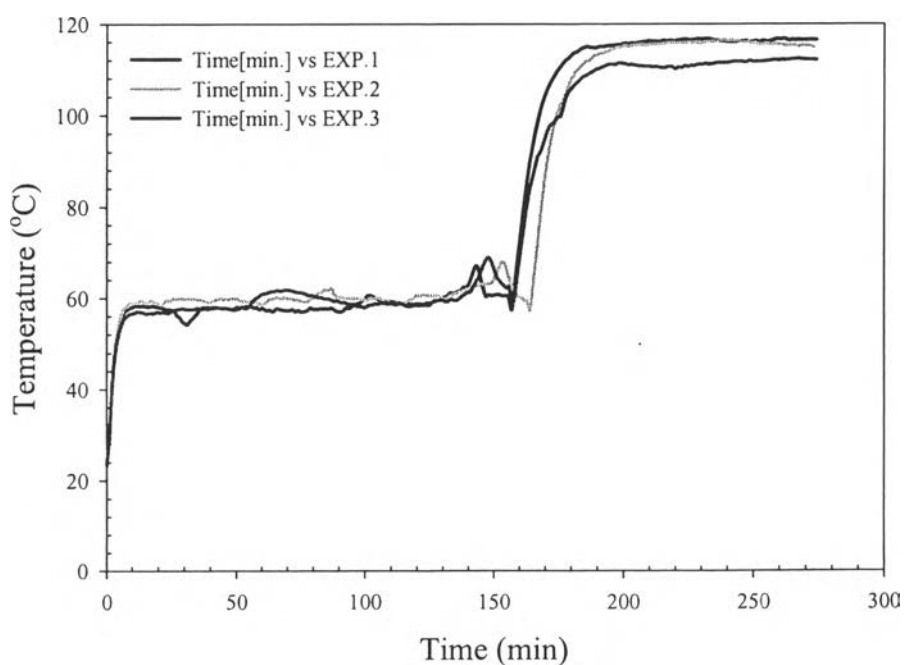


Figure A5 Temperature profiles of P-136 sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

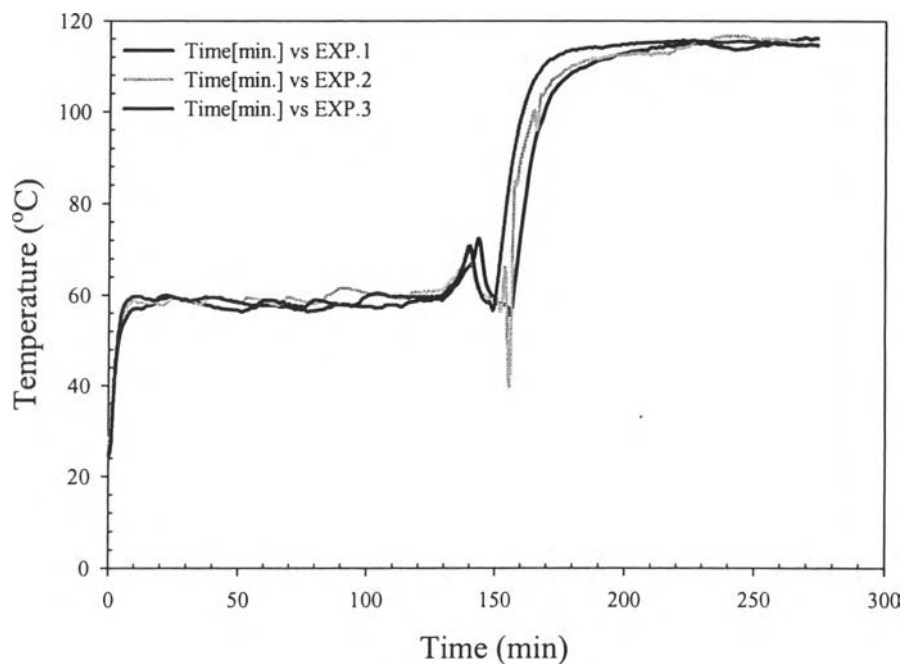


Figure A6 Temperature profiles of P-137 sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

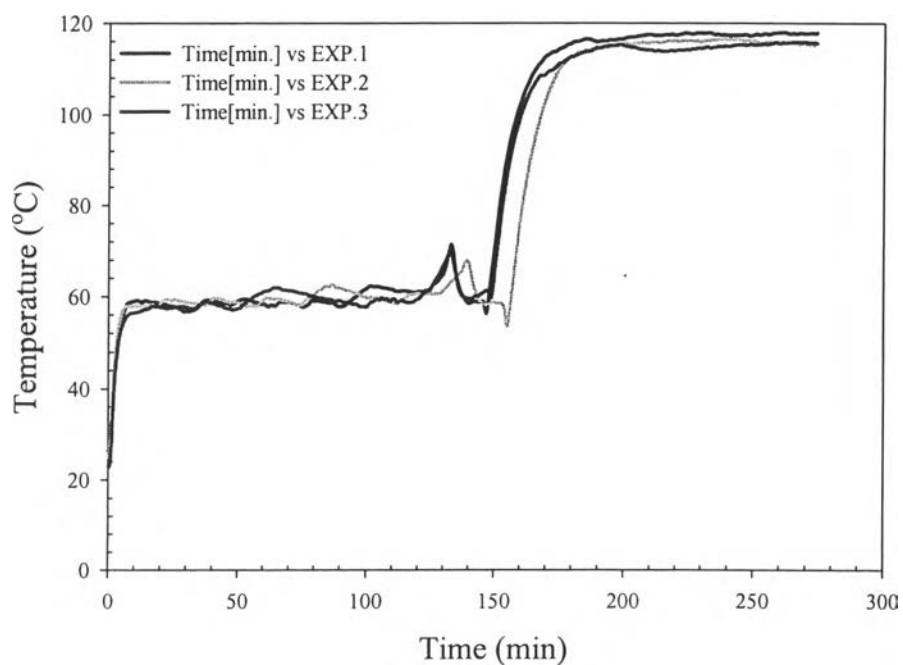


Figure A7 Temperature profiles of P-235 sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

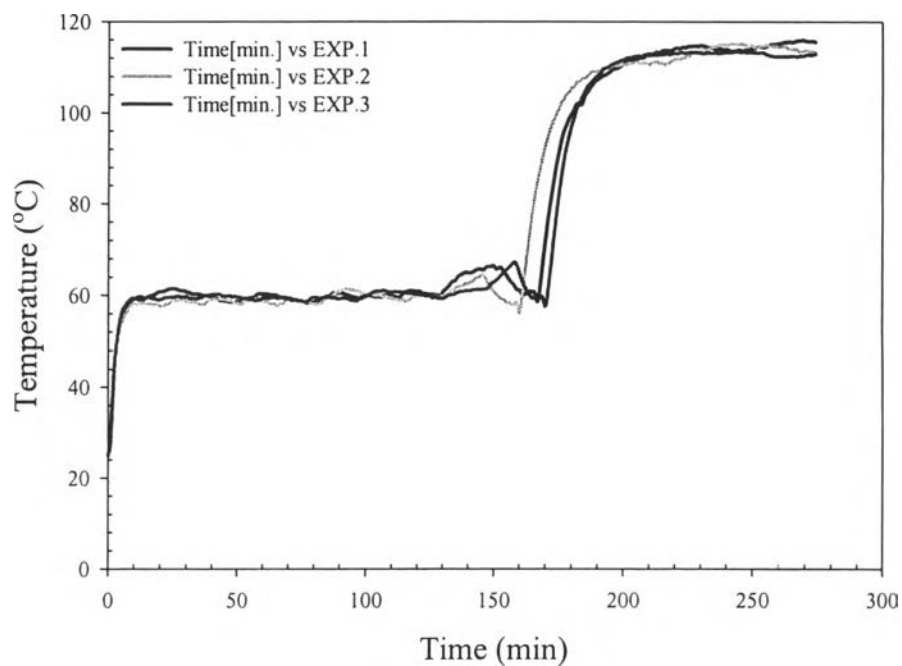


Figure A8 Temperature profiles of P-302 sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

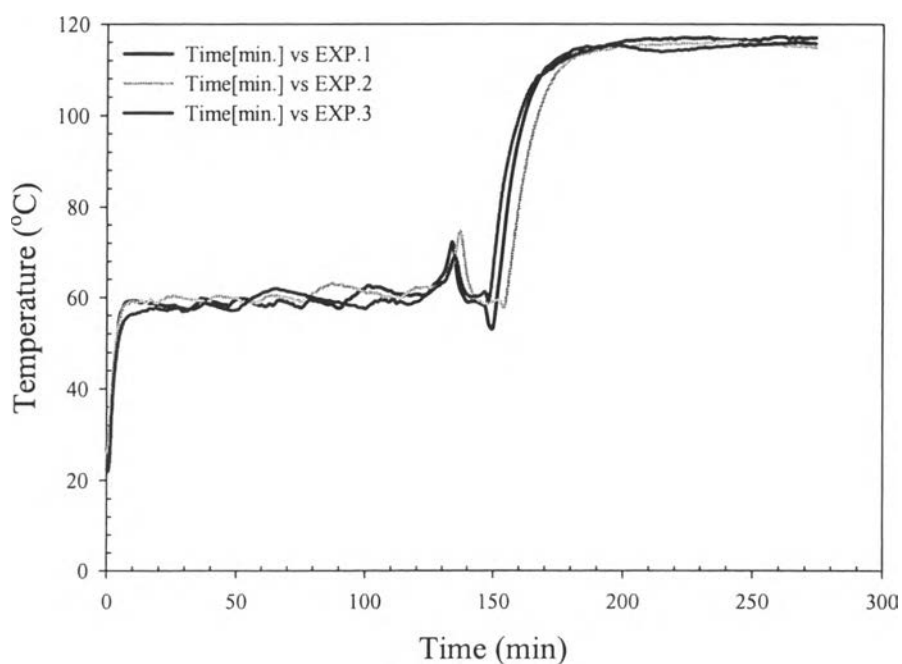


Figure A9 Temperature profiles of P-327 sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

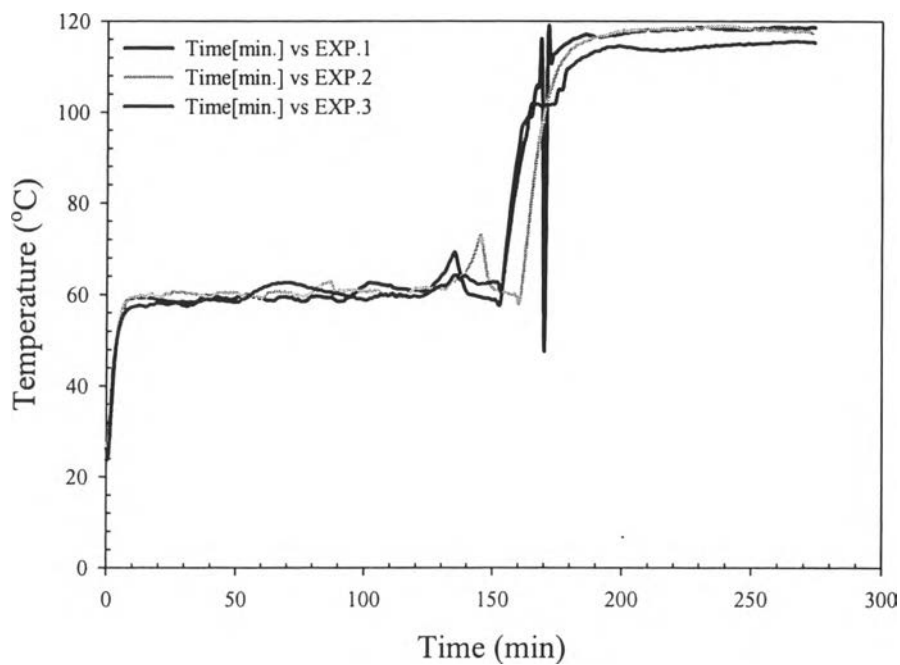


Figure A10 Temperature profiles of P-348 sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

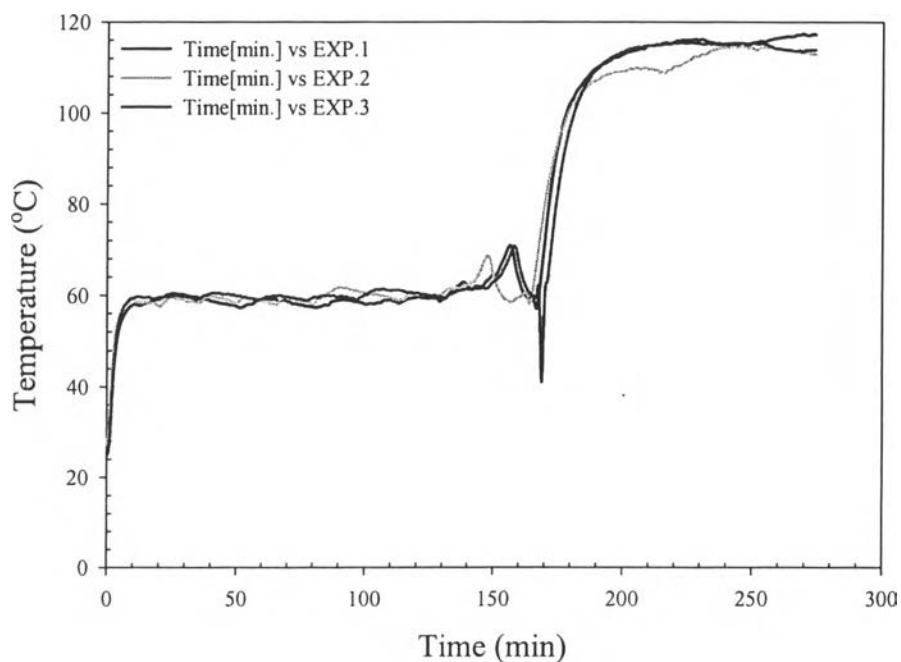


Figure A11 Temperature profiles of P-373 sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

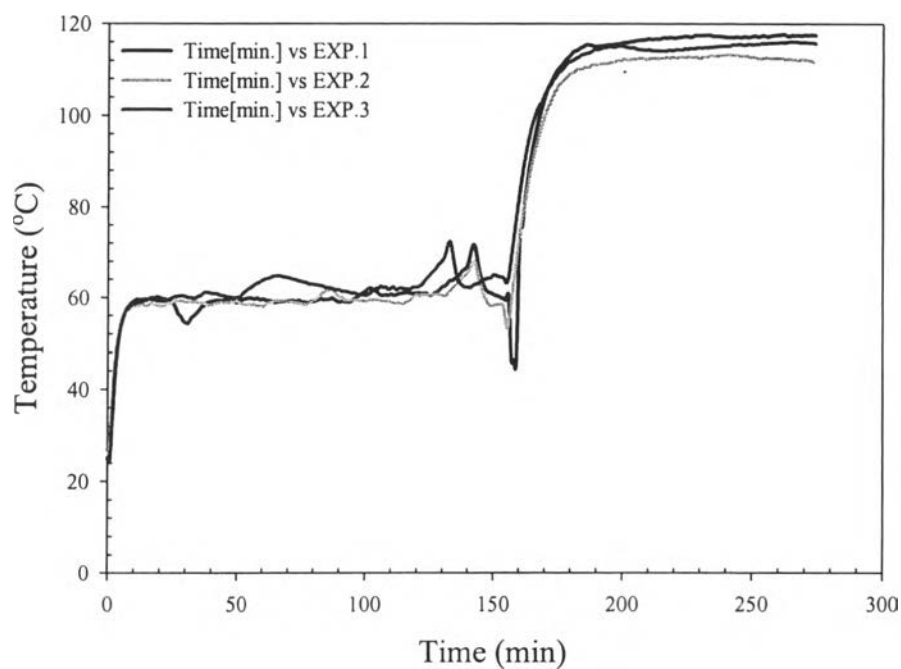


Figure A12 Temperature profiles of P-422 K sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

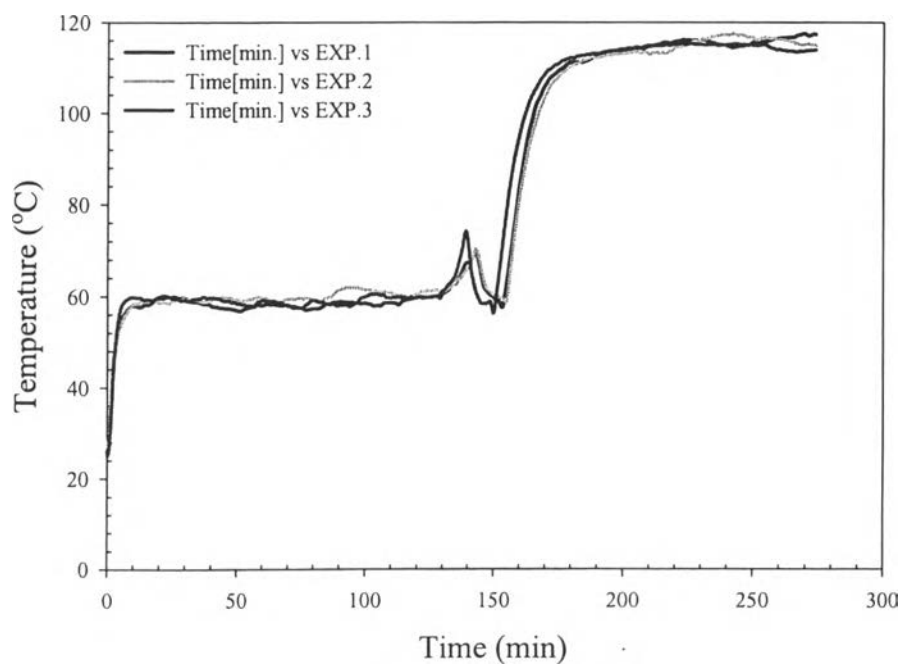


Figure A13 Temperature profiles of P-433 S sheets with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

APPENDIX B **Temperature profiles of colored PMMA sheets with 0.038% ADVN**

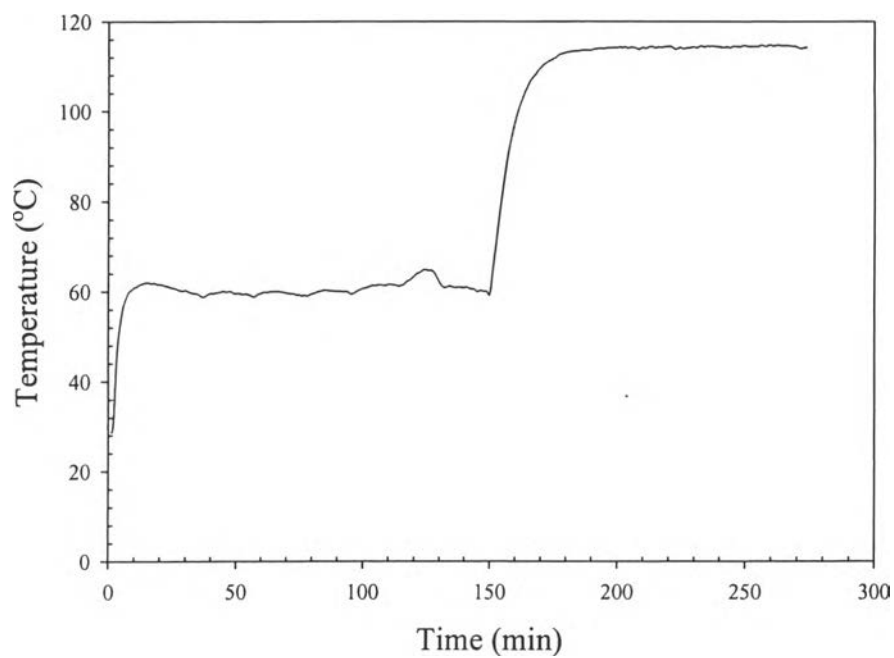


Figure B1 Temperature profile of transparent sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

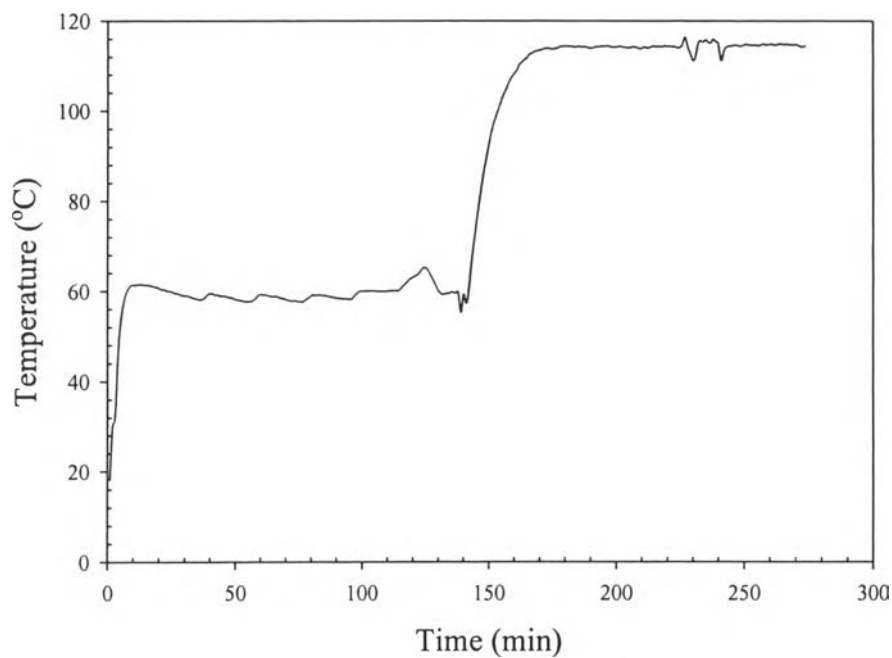


Figure B2 Temperature profile of P-018 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

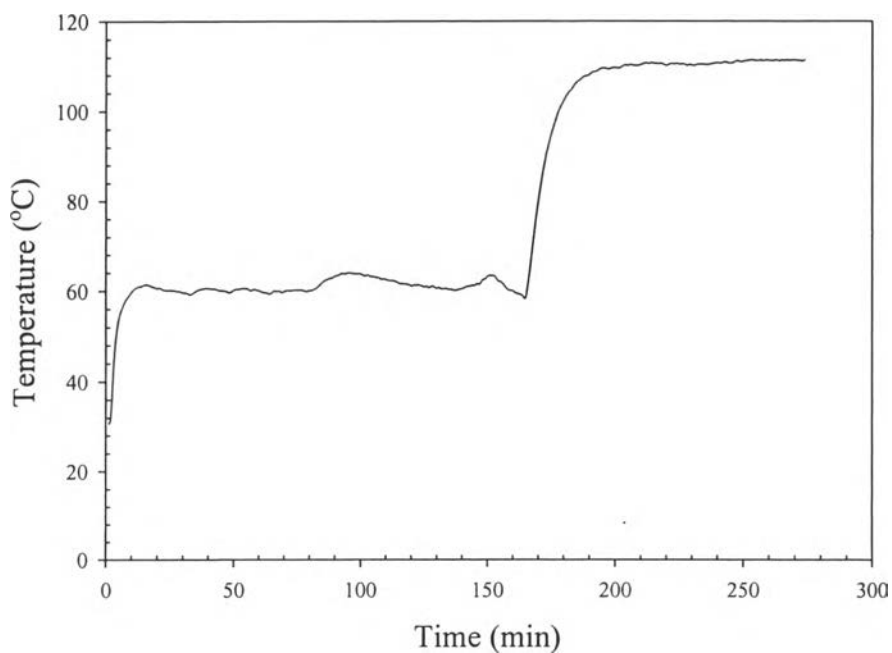


Figure B3 Temperature profile of P-102 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

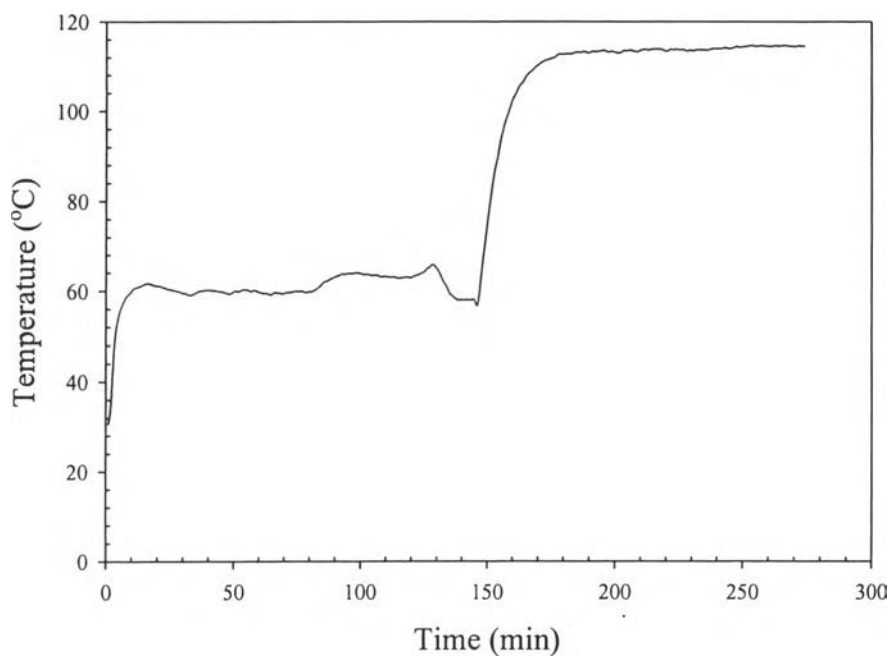


Figure B4 Temperature profile of P-115 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

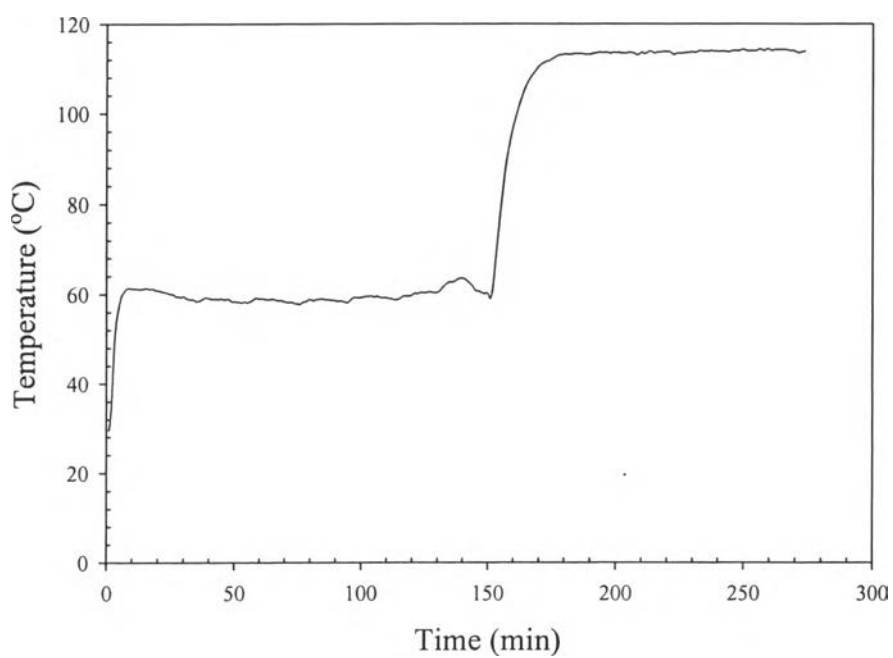


Figure B5 Temperature profile of P-136 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

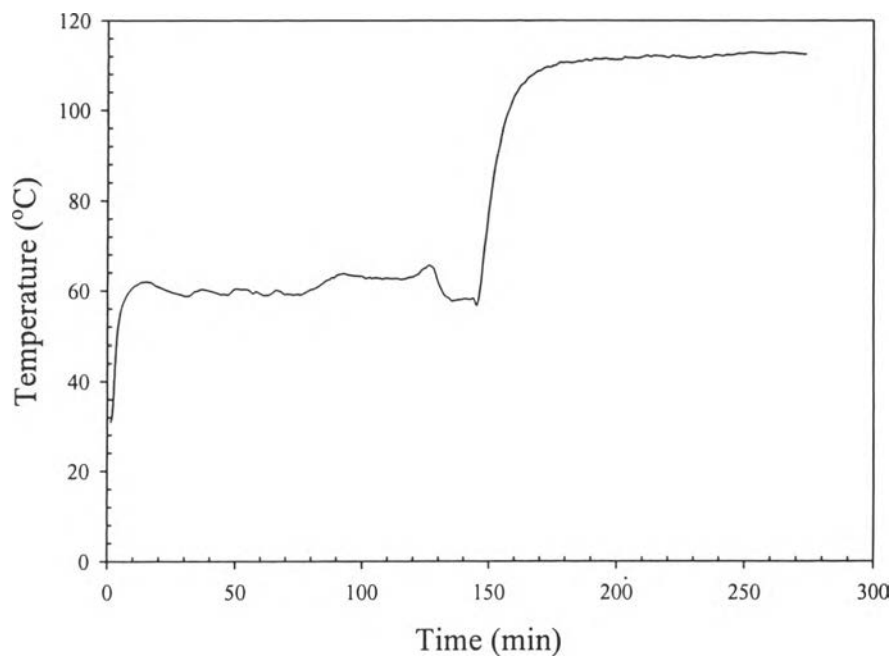


Figure B6 Temperature profile of P-137 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

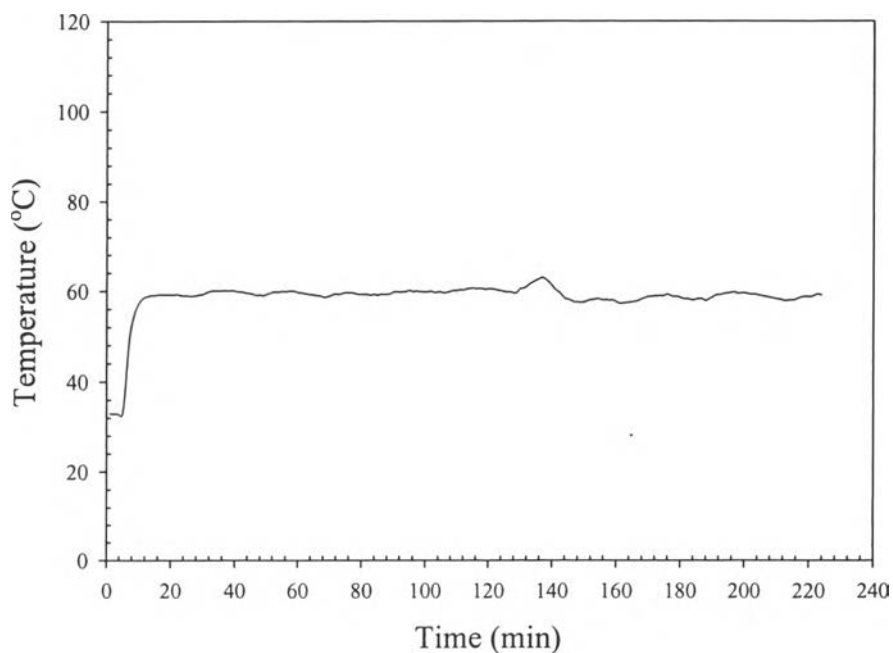


Figure B7 Temperature profile of P-202 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

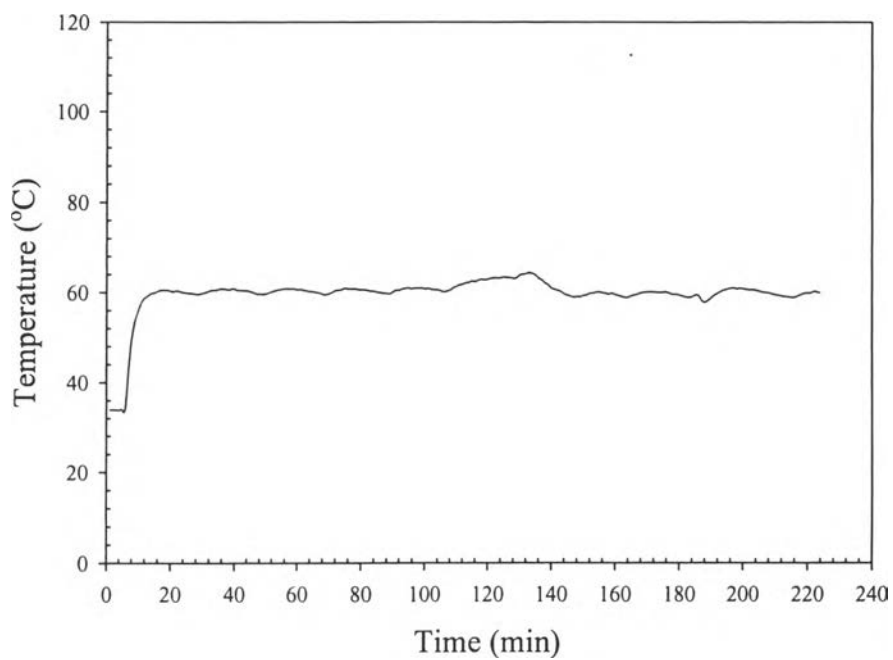


Figure B8 Temperature profile of P-212 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

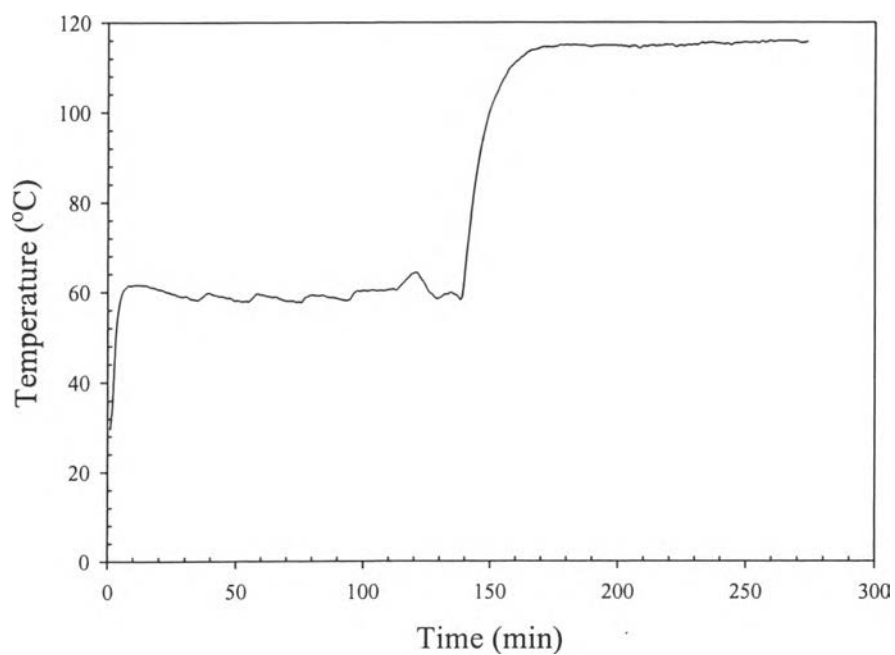


Figure B9 Temperature profile of P-235 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

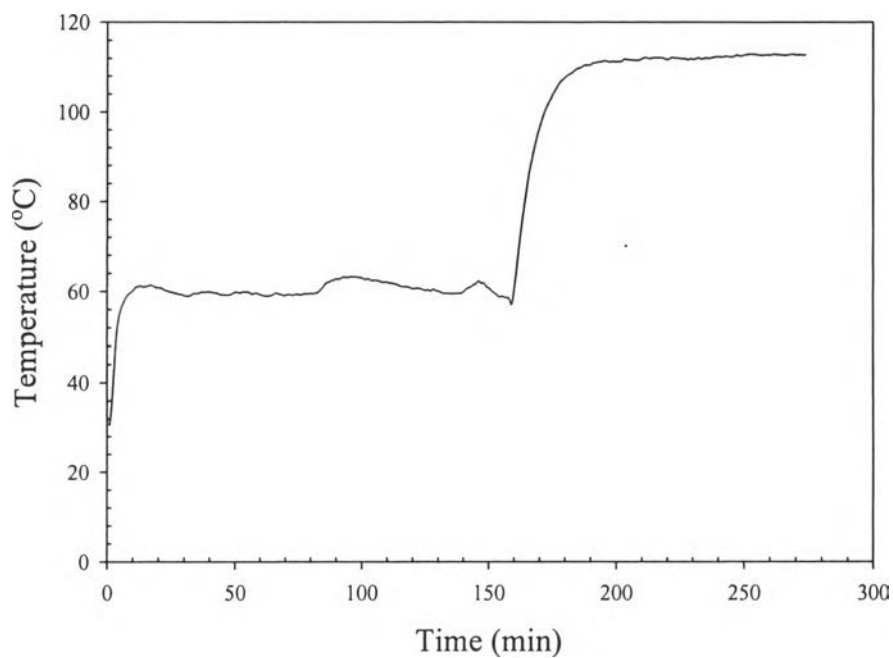


Figure B10 Temperature profile of P-302 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

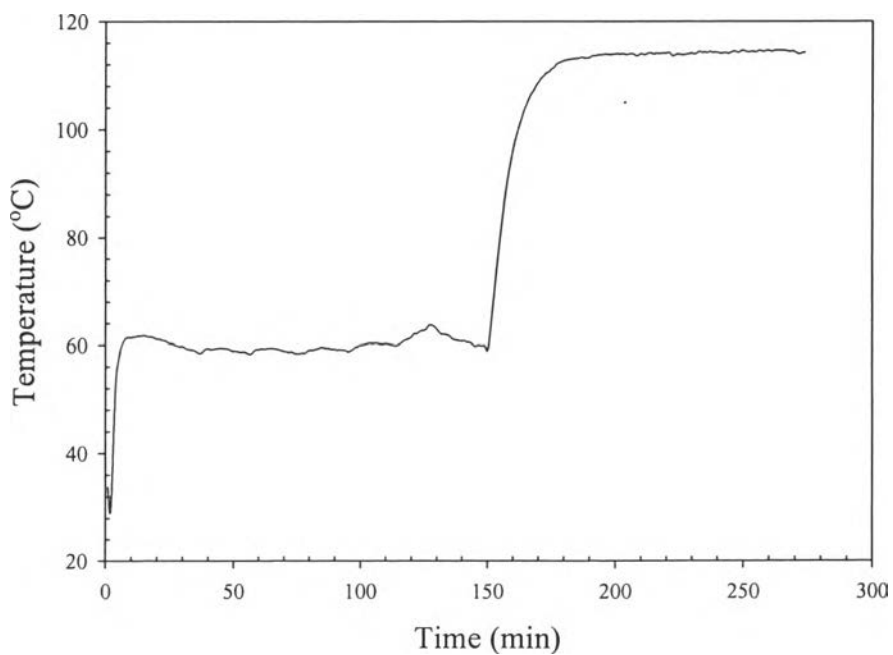


Figure B11 Temperature profile of P-327 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

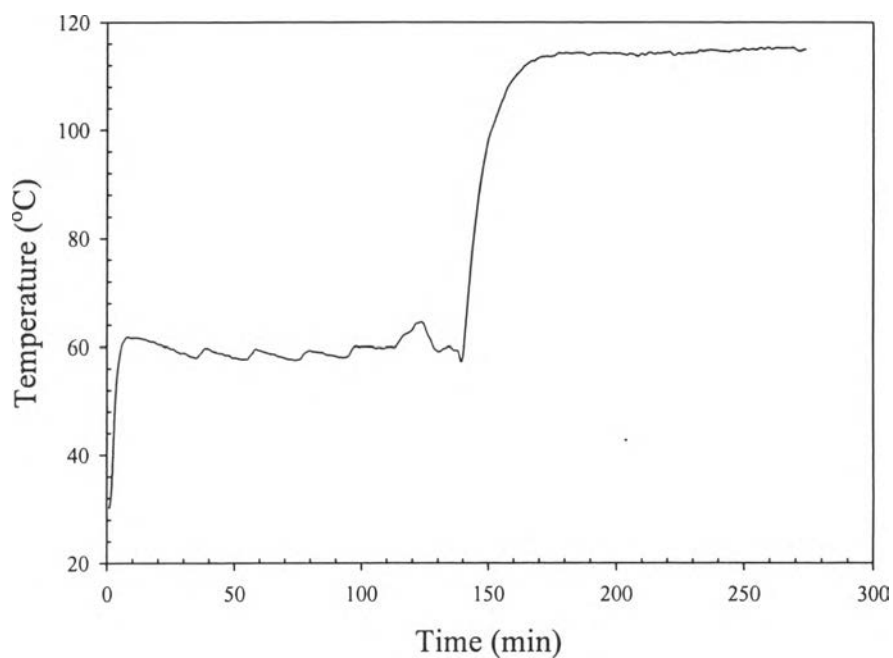


Figure B12 Temperature profile of P-348 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

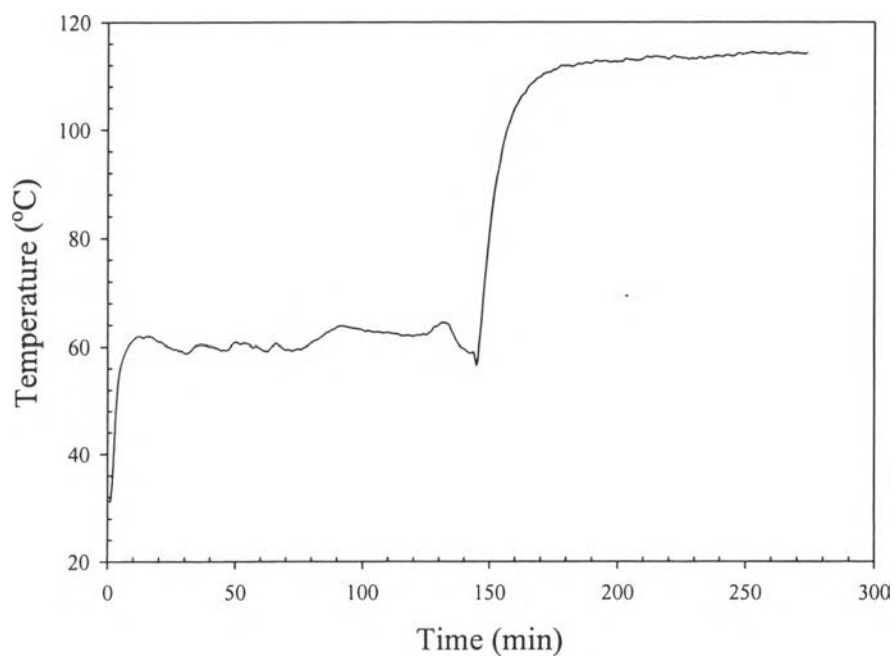


Figure B13 Temperature profile of P-373 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

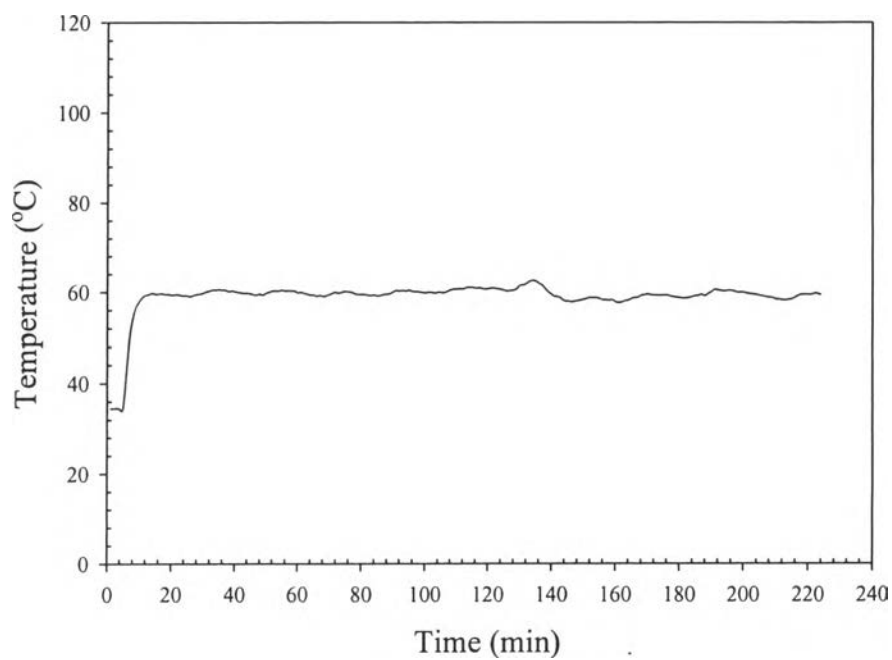


Figure B14 Temperature profile of P-402 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

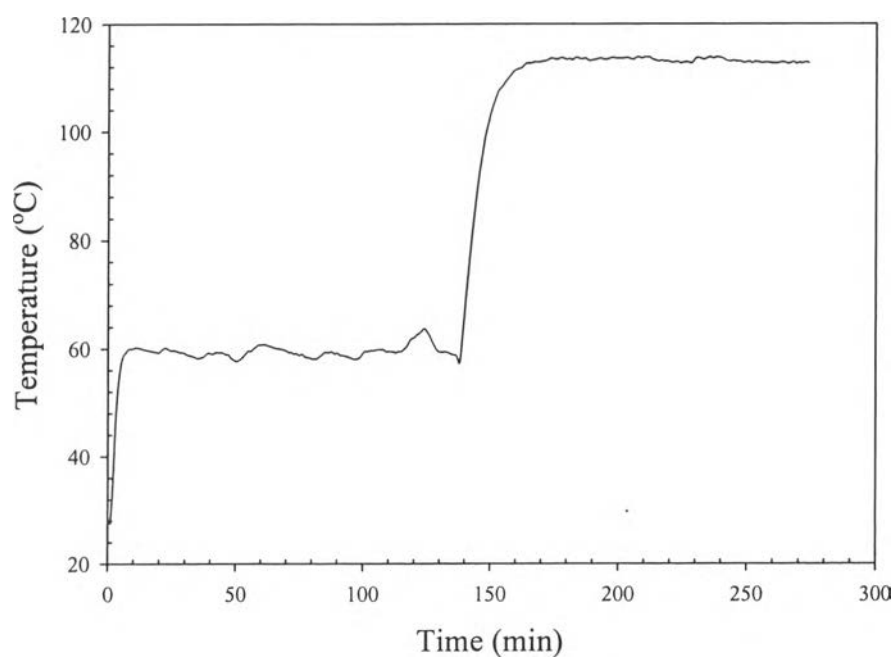


Figure B15 Temperature profile of P-422 K sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

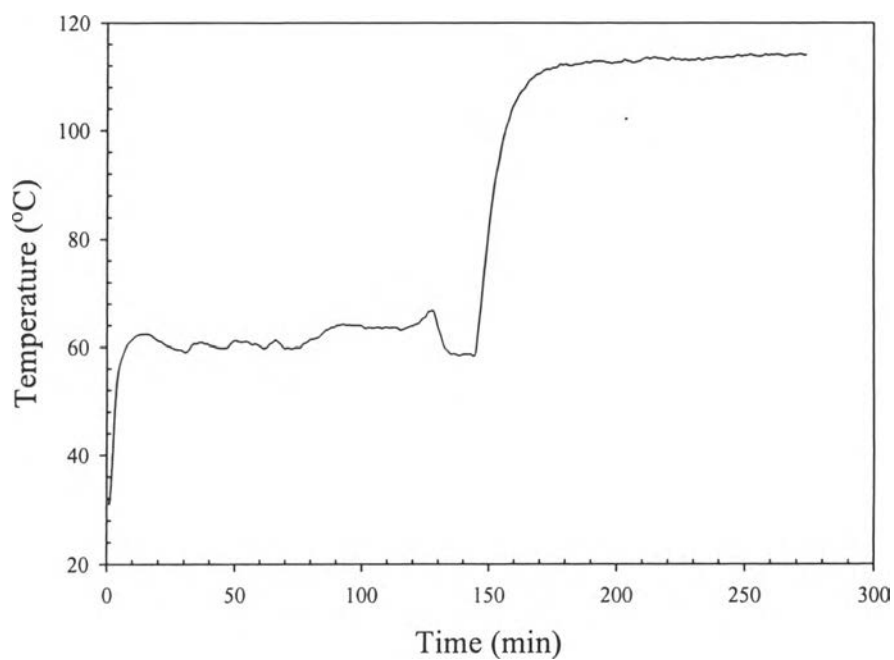


Figure B16 Temperature profile of P-433 S sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

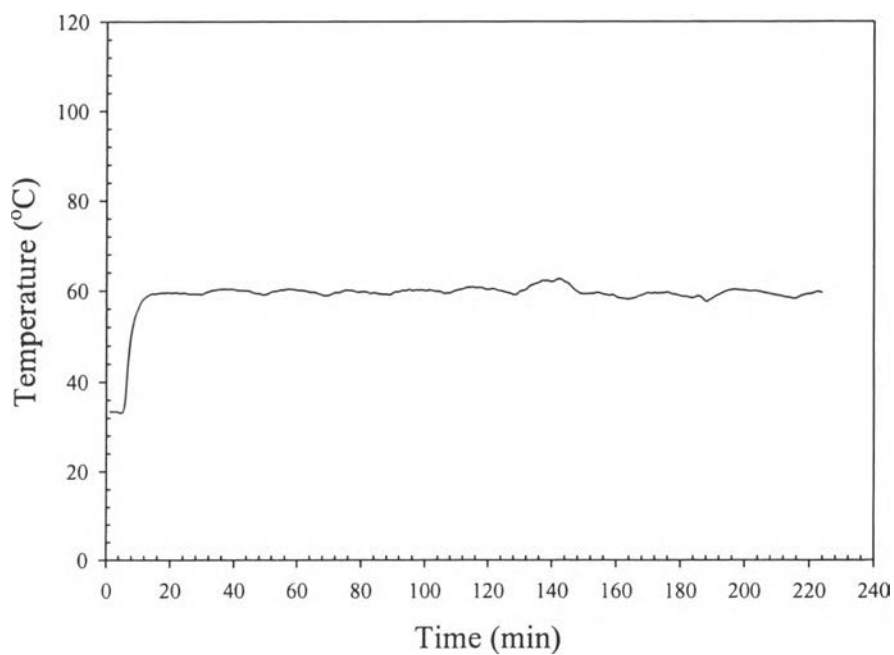


Figure B17 Temperature profile of P-502 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

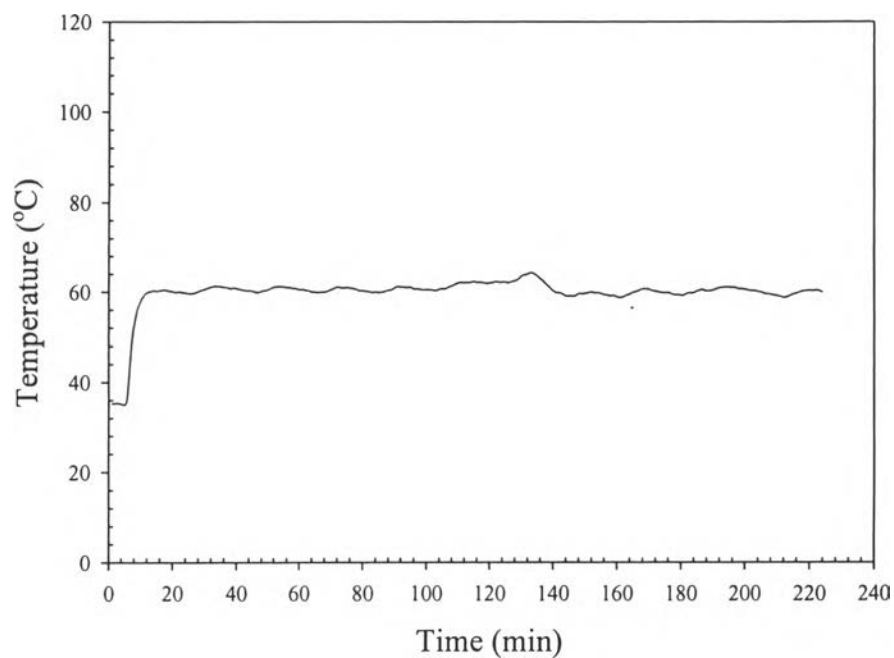


Figure B18 Temperature profile of P-522 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

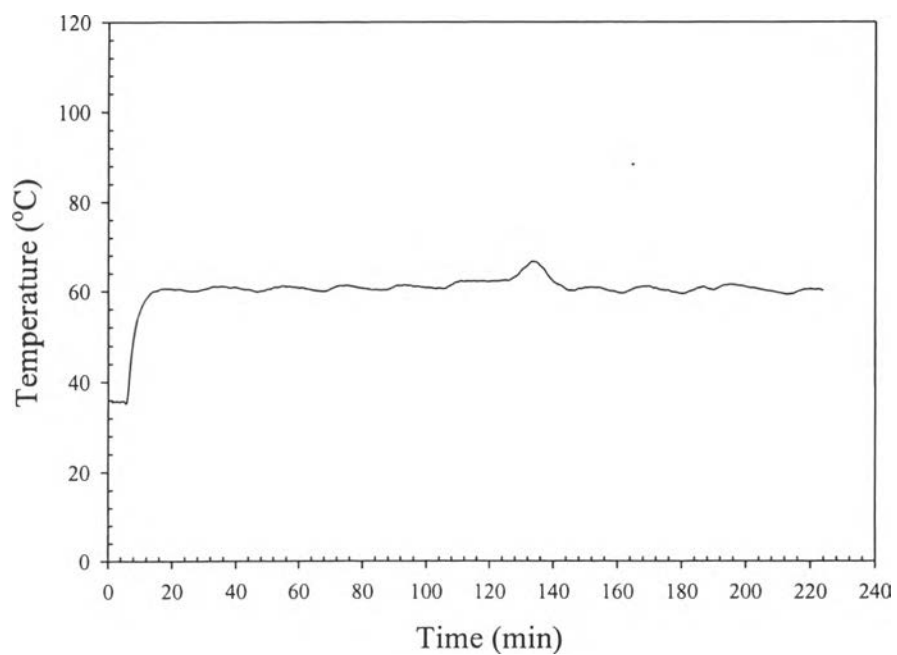


Figure B19 Temperature profile of P-531 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

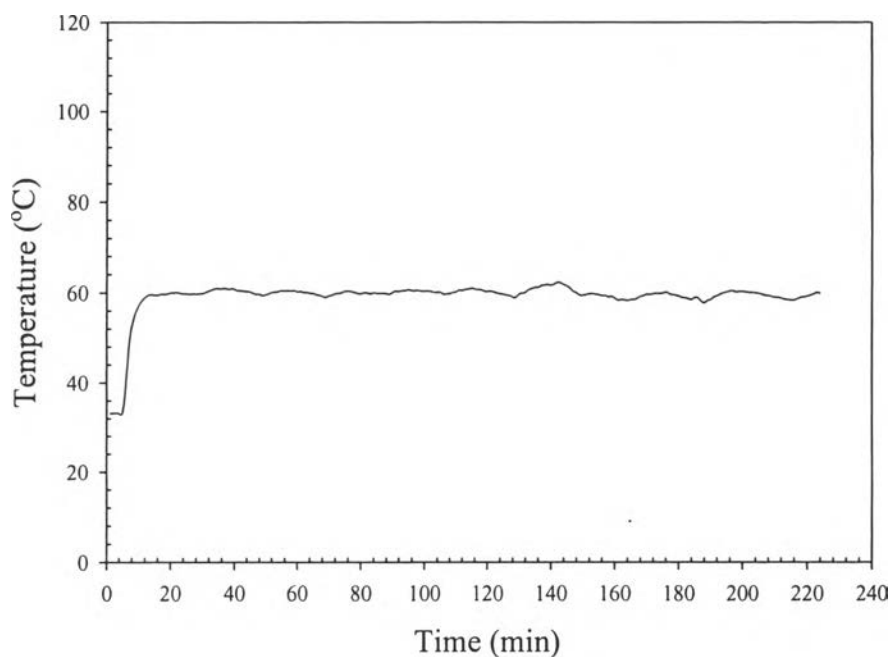


Figure B20 Temperature profile of P-814 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

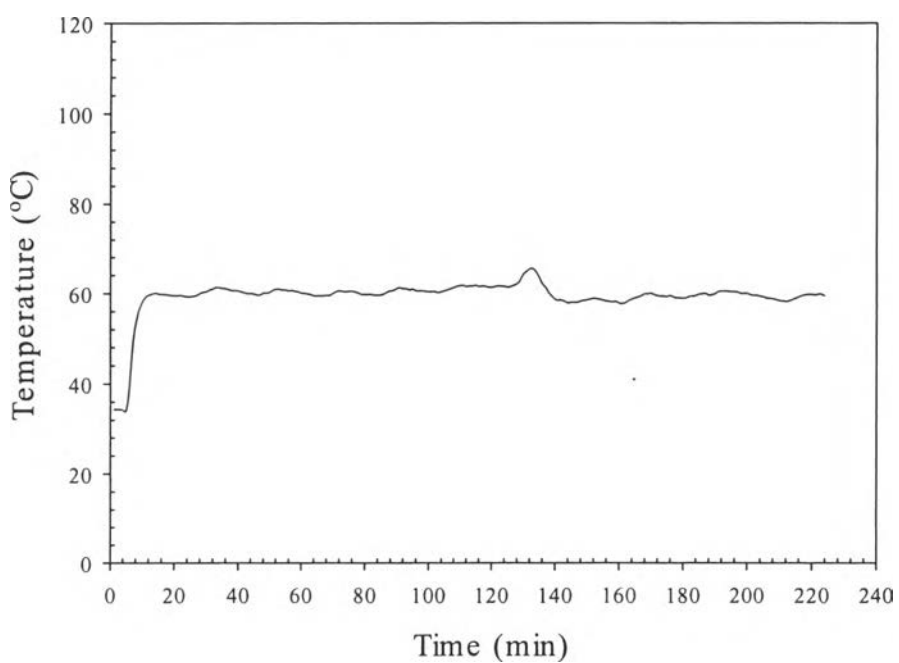


Figure B21 Temperature profile of P-993 sheet with the different type and concentration of initiator polymerized and annealed at 60°C and 120°C, respectively.

APPENDIX C Molecular weight average of 5 mm thickness PMMA sheet

Molecular weight average was measured by gel permeation chromatography. These results run by National Metal and Materials Technology Center (MTEC).

Instrument: GPC, Waters 150-CV
Test conditions:
Eluent: Tetrahydrofuran, Flow rate 1.0 ml / min
Injection volume: 100 μ l, Temperature 30°C
Column set: Plgel 10 μ m mixed B 2 columns
 MW resolving range 500-10,000,000
Polymer standard: Polystyrene
Calibration method: Polystyrene standard calibration (MW 5,460-1,290,000)

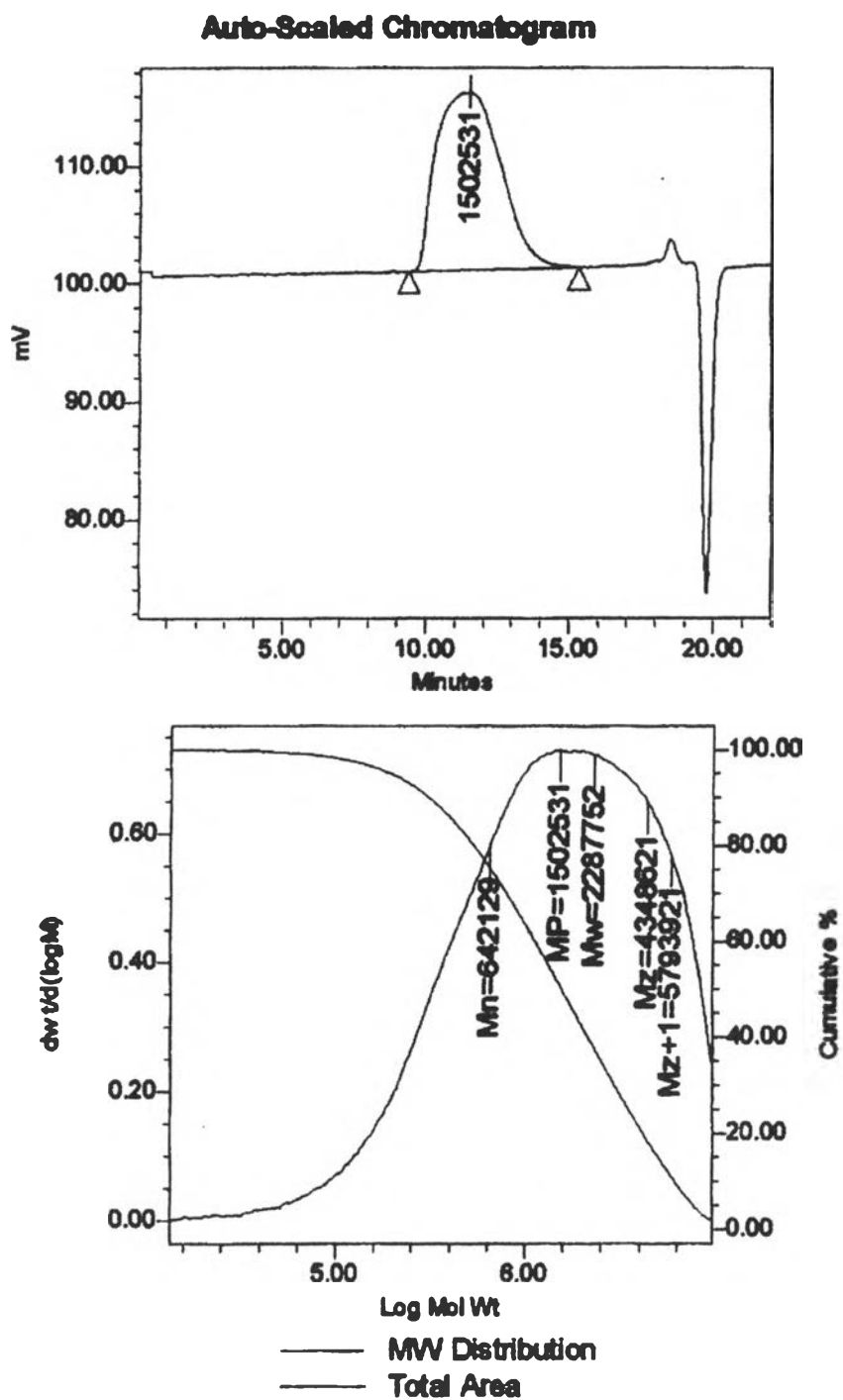


Figure C1 GPC result of sample 5 mm thickness PMMA sheet with ADVN 0.015% polymerized at 60°C.

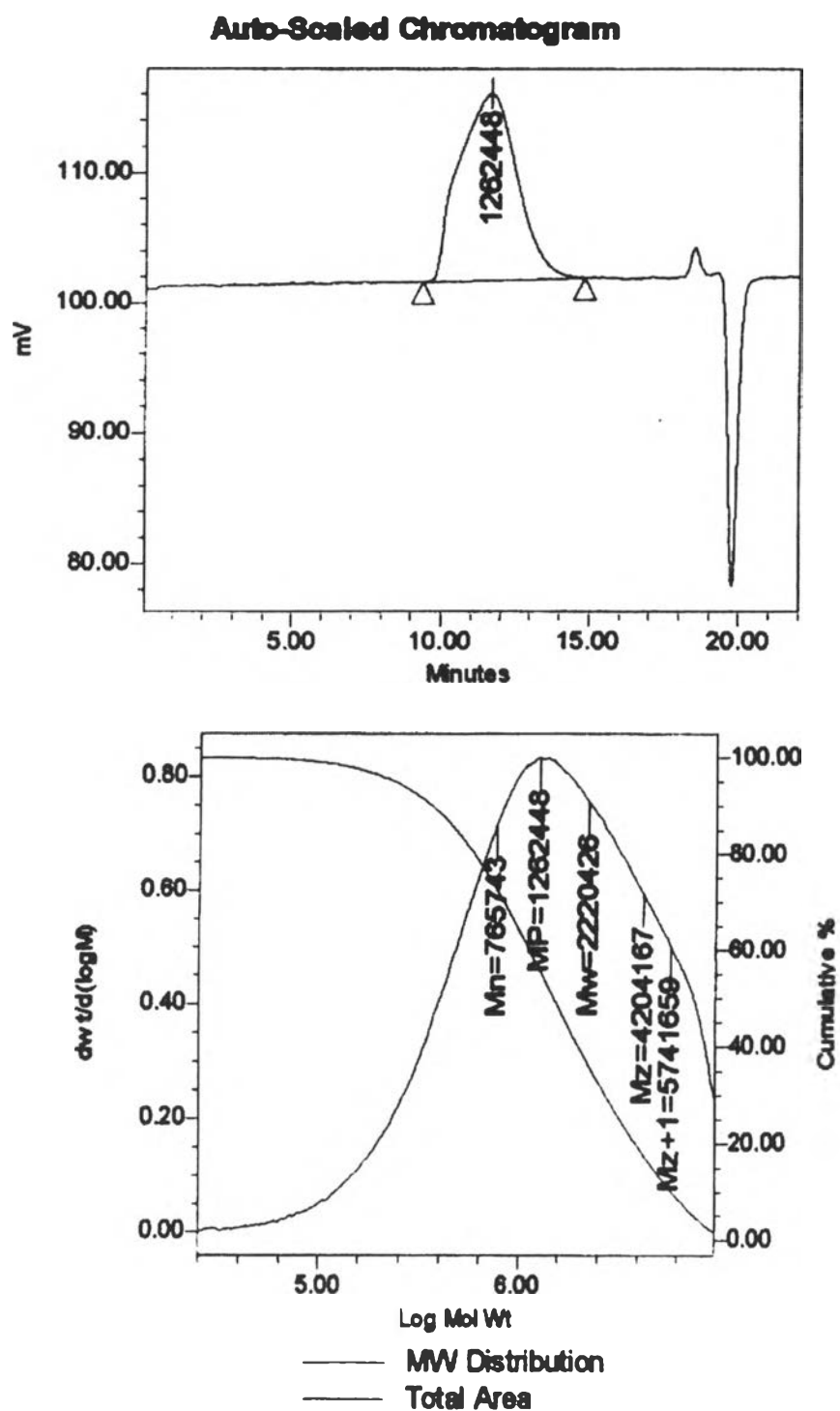


Figure C2 GPC result of sample 5 mm thickness PMMA sheet with ADVN 0.018% polymerized at 60°C.

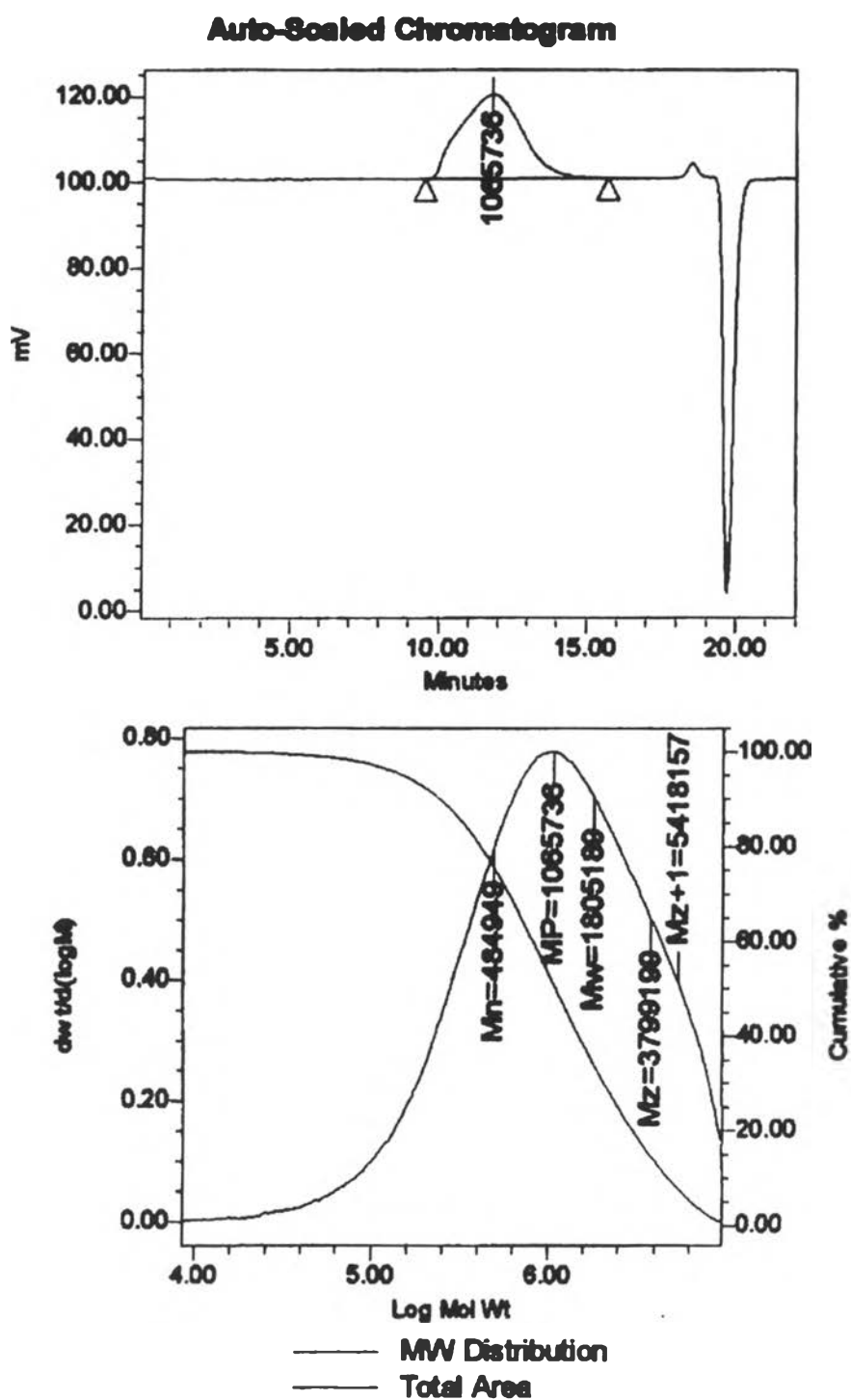


Figure C3 GPC result of sample 5 mm thickness PMMA sheet with ADVN 0.022% polymerized at 60°C.

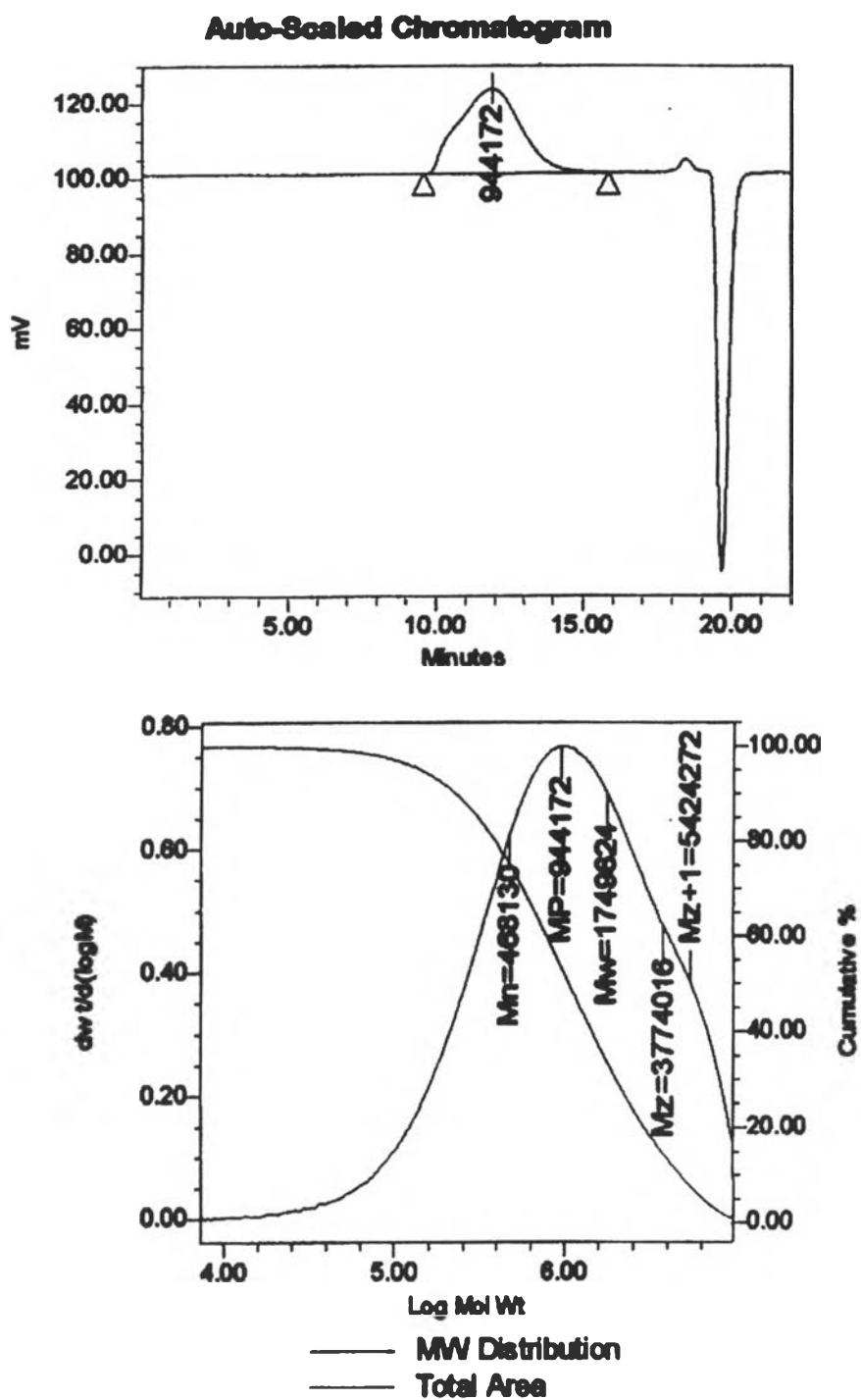


Figure C4 GPC result of sample 5 mm thickness PMMA sheet with ADVN 0.015% polymerized at 60°C and annealed at 120°C.

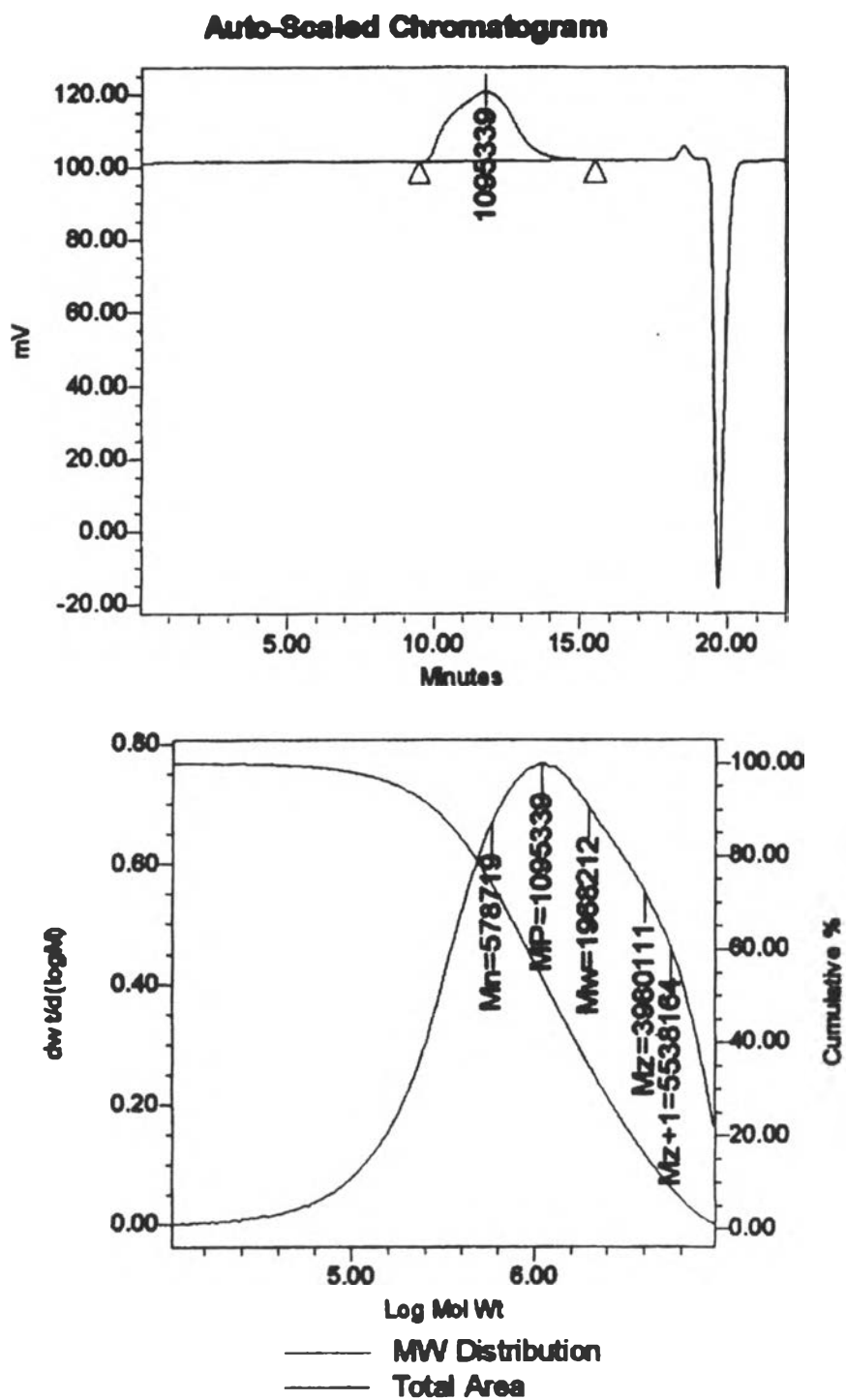


Figure C5 GPC result of sample 5 mm thickness PMMA sheet with ADVN 0.018% polymerized at 60°C and annealed at 120°C.

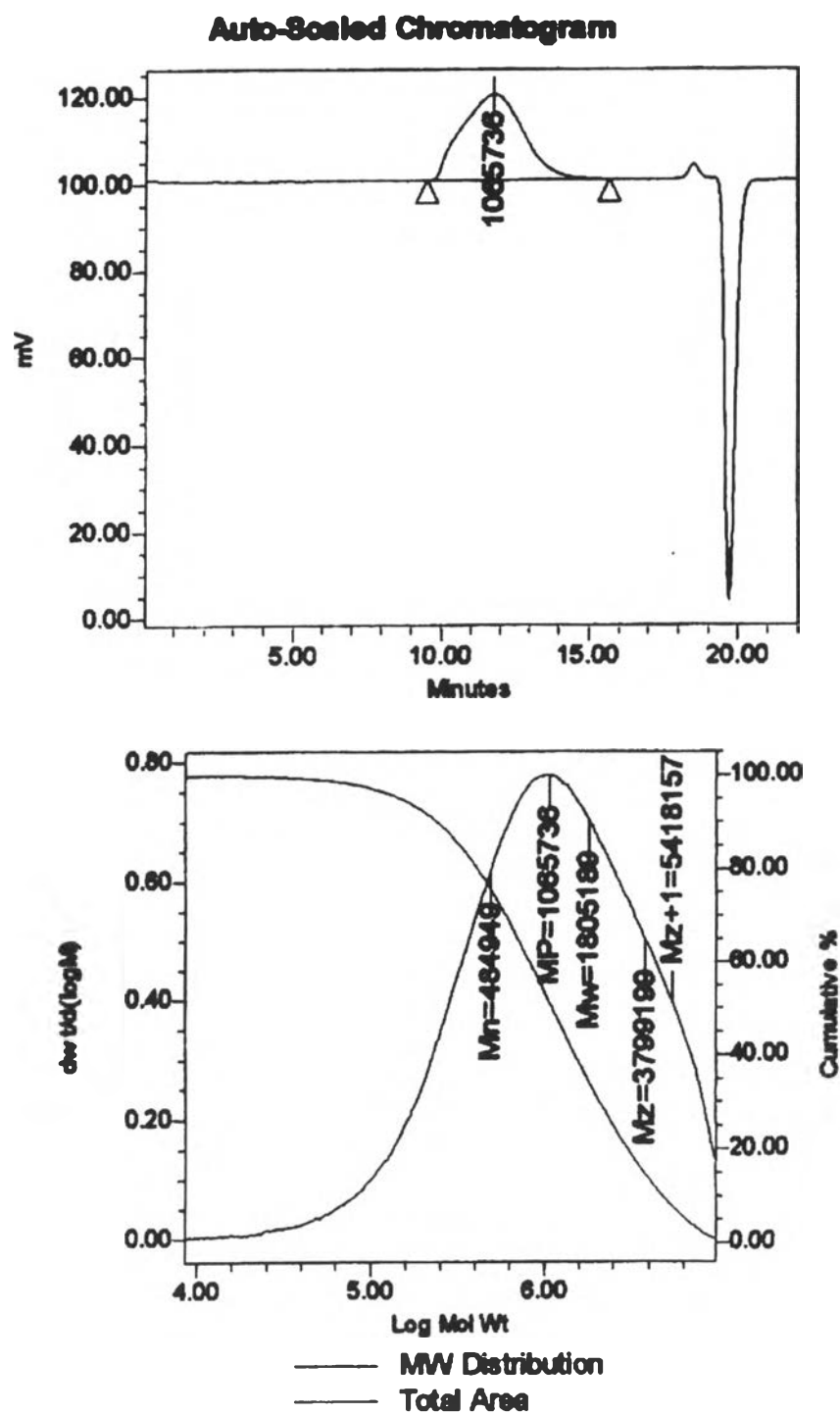


Figure C6 GPC result of sample 5 mm thickness PMMA sheet with ADVN 0.022% polymerized at 60°C and annealed at 120°C.

APPENDIX D Surface hardness of the selected samples in Scale-M unit.

Table D1 The surface hardness of 5 mm thickness with 0.015%, 0.018%, and 0.022% ADVN polymerized at 60°C and annealed at 120°C

ADV N	1	2	3	4	5	6	7	8	9	10
.015[1]	37.3	38.0	36.9	39.6	37.4	40.5	38.9	41.9	37.6	38.0
.018[1]	51.0	52.9	52.8	53.0	54.5	54.8	52.8	50.8	51.6	51.7
.022[1]	69.3	69.0	67.7	65.8	71.3	67.9	66.2	70.0	71.1	66.3
.015[2]	101.0	101.5	102.1	102.1	101.9	102.4	102.5	102.5	102.9	101.4
.018[2]	101.6	101.8	102.7	103.0	101.6	102.8	102.3	102.5	103.1	103.1
.022[2]	101.4	101.6	102.1	103.9	101.6	102.3	102.0	101.9	102.1	102.2

Table D2 The surface hardness of 8 mm thickness with 0.008%, 0.011%, and 0.013% ADVN polymerized at 60°C and annealed at 120°C

ADV N	1	2	3	4	5	6	7	8	9	10
.008[1]	46.8	43.4	43.5	42.0	46.0	45.4	45.0	45.9	43.4	46.8
.011[1]	62.5	60.1	65.0	60.5	60.7	67.5	70.9	72.5	64.6	64.1
.013[1]	85.6	88.8	89.7	88.7	89.5	88.0	86.2	88.8	88.8	84.7
.008[2]	104.3	103.6	103.0	103.9	102.8	103.9	104.2	103.3	104.6	104.2
.011[2]	102.1	102.2	102.3	103.2	102.1	102.7	102.8	103.1	102.9	103.3
.013[2]	101.5	101.9	103.1	101.7	102.2	101.4	101.9	102.2	100.8	101.6

Table D3 The surface hardness of 10 mm thickness with 0.004%, 0.006%, and 0.008% ADVN polymerized at 60°C and annealed at 120°C

ADV N	1	2	3	4	5	6	7	8	9	10
.004[1]	36.5	34.3	34.4	36.9	32.7	32.8	36.1	32.2	34.6	33.8
.006[1]	45.3	43.9	43.5	45.0	43.0	43.6	48.2	45.4	43.9	46.5
.008[1]	68.8	69.0	69.1	71.9	73.7	70.5	67.5	72.7	71.4	70.0
.004[2]	99.6	100.3	102.7	100.5	100.7	101.6	100.3	100.1	102.3	101.1
.006[2]	102.4	103.1	103.4	103.1	102.6	101.9	103.0	103.1	103.6	101.7
.008[2]	100.3	100.7	101.1	100.2	100.0	103.2	101.7	99.3	101.0	101.2

Table D4 The surface hardness of 3 mm selected colored samples with 0.15% AIBN polymerized at 60°C and annealed at 120°C (the first experiment sample)

	1	2	3	4	5	6	7	8	9	10
P000	97.5	98.1	98.6	97.1	97.5	97.4	97.1	96.8	97.1	96.8
P018	97.5	97.7	97.5	97.6	97.9	98.2	99.2	98.3	96.2	98.2
P102	95.7	96.7	96.5	97.0	96.6	96.6	97.0	96.9	96.9	96.9
P115	97.4	97.3	96.6	96.9	97.1	97.3	96.0	97.3	96.1	96.4
P136	98.3	98.0	97.4	98.0	98.4	99.0	97.4	97.2	97.0	96.6
P137	95.6	96.6	95.4	95.7	95.9	96.1	95.6	96.6	95.8	95.3
P235	96.4	95.4	97.3	96.6	96.3	96.2	97.1	98.4	96.2	96.3
P302	97.2	96.3	97.7	98.1	98.4	98.3	98.1	98.1	98.3	98.1
P325	94.6	94.9	95.1	95.5	95.8	94.4	93.1	95.8	94.4	93.3
P348	97.0	96.6	96.8	97.3	97.1	96.6	96.4	96.7	96.0	96.2
P373	99.3	98.4	98.2	99.8	99.2	99.7	97.2	99.2	98.9	94.9
P422K	95.9	94.7	94.5	94.5	95.5	96.0	94.8	95.4	95.3	95.6
P433S	97.1	97.0	96.8	96.9	96.8	97.1	97.1	97.0	97.2	96.8

Table D5 The surface hardness of 3 mm selected colored samples with 0.15% AIBN polymerized at 60°C and annealed at 120°C (the second experiment sample)

	1	2	3	4	5	6	7	8	9	10
P000	96.1	97.4	97.3	97.1	97.4	98.1	97.2	98.1	98.0	97.7
P018	95.6	94.7	95.6	95.8	95.9	96.6	95.4	95.4	95.1	95.8
P102	98.0	97.6	98.5	99.4	99.4	99.6	98.6	97.9	97.9	98.6
P115	98.2	97.4	96.7	97.6	97.3	97.8	97.6	97.6	97.1	97.2
P136	95.5	95.8	96.4	96.1	95.5	95.5	95.6	96.0	95.4	96.7
P137	97.6	97.2	96.9	96.6	96.8	97.1	96.3	96.5	97.1	96.7
P235	96.5	96.3	96.7	97.5	97.0	97.6	97.5	97.2	97.8	97.7
P302	96.9	96.8	96.5	96.5	96.5	96.3	96.8	96.5	96.2	95.9
P325	96.3	96.4	96.8	97.1	96.7	97.1	97.4	97.4	96.8	97.4
P348	98.0	97.5	98.7	98.7	98.7	98.1	98.4	98.3	98.8	98.0
P373	96.3	96.1	96.7	96.9	97.0	97.4	97.3	97.3	97.3	97.5
P422K	96.5	96.2	96.1	96.0	96.0	96.0	97.0	96.6	96.5	95.9
P433S	98.1	97.7	96.9	97.9	98.2	97.3	97.5	98.0	98.2	98.0

Table D6 The surface hardness of 3 mm selected colored samples with 0.15% AIBN polymerized at 60°C and annealed at 120°C (the third experiment sample)

	1	2	3	4	5	6	7	8	9	10
P000	96.9	97.1	96.6	96.3	97.0	96.5	96.3	96.1	97.0	96.4
P018	95.9	95.8	96.2	95.7	96.1	97.9	95.5	96.1	95.5	96.3
P102	97.1	98.4	97.6	96.5	96.8	96.3	97.5	98.3	99.2	98.2
P115	97.3	97.6	97.0	97.2	97.5	97.9	97.5	97.4	97.7	97.1
P136	96.8	96.5	97.0	97.2	96.8	97.1	97.5	97.0	98.4	97.4
P137	97.3	97.1	97.0	97.3	97.2	97.7	97.2	98.0	97.7	97.6
P235	96.0	96.2	96.2	96.1	95.5	96.2	96.6	96.0	96.5	95.9
P302	98.6	96.9	96.6	97.0	96.9	98.1	99.2	97.9	97.1	96.7
P325	97.5	98.2	98.8	97.9	97.7	97.3	97.5	97.8	97.4	97.8
P348	96.1	96.9	96.0	97.1	96.1	96.2	96.2	97.1	96.9	94.9
P373	96.6	97.8	96.2	98.6	96.6	97.1	98.5	96.7	96.7	96.6
P422K	96.3	97.0	98.7	96.0	96.7	96.4	96.9	96.4	96.3	96.4
P433S	95.6	96.1	95.2	95.6	94.2	96.4	96.7	96.3	96.2	96.0

Table D7 The surface hardness of 3 mm selected colored samples with 0.038% ADVN polymerized at 60°C and annealed at 120°C

	1	2	3	4	5	6	7	8	9	10
P000	98.1	98.0	98.9	99.4	99.0	98.4	98.7	98.3	98.9	99.4
P018	98.7	98.6	98.7	98.7	98.4	98.1	98.2	97.5	98.3	98.3
P102	97.9	97.7	97.0	98.3	97.9	97.4	97.4	97.3	96.5	96.9
P115	96.7	98.2	98.3	98.4	98.7	97.7	97.2	97.4	99.3	96.7
P136	98.9	98.0	97.2	97.9	98.9	98.8	98.1	98.7	98.8	98.6
P137	97.5	97.5	98.0	96.4	96.9	98.5	97.8	96.1	97.6	97.4
P202	100.6	100.3	99.5	101.1	100.0	98.8	100.5	100.4	100.4	100.3
P212	99.8	101.0	99.9	101.6	99.7	99.7	100.7	102.0	99.6	102.1
P235	98.3	98.8	100.0	96.2	95.8	97.4	100.3	97.2	97.5	97.8
P302	98.7	98.6	98.2	98.4	98.5	98.1	98.3	98.2	98.6	99.1
P327	96.7	97.5	96.7	97.5	98.4	97.5	97.4	97.6	98.1	98.2
P348	97.5	97.1	96.7	96.9	97.6	98.4	97.5	97.5	97.4	96.9
P373	97.5	98.1	97.9	97.1	98.7	97.8	97.8	97.1	97.4	98.1
P402	96.1	101.2	99.6	96.3	91.4	96.0	96.8	96.2	101.1	99.7
P422K	97.1	96.5	99.2	98.4	98.8	94.2	97.3	96.2	97.4	95.9
P433S	96.4	98.1	98.2	99.5	97.2	98.4	98.8	97.6	96.7	97.2
P502	99.3	100.1	101.6	100.4	98.3	100.3	100.5	101.3	101.3	100.6
P522	99.6	101.1	99.6	94.9	95.9	101.9	101.2	98.8	98.6	99.9
P531	97.9	100.2	100.4	101.1	100.6	99.0	98.2	99.2	100.0	101.9
P814	99.1	99.9	100.7	99.0	98.7	100.1	98.8	100.5	99.8	99.7
P993	99.6	99.2	100.4	100.7	100.6	99.7	101.6	99.5	99.7	101.2

APPENDIX E Impact resistant of the selected samples in kJ / m² unit.

Table E1 The impact resistance of 3 mm selected colored samples with 0.15% AIBN polymerized at 60°C and annealed at 120°C

	1	2	3	4	5	6	7	8	9	10
P000	20.1	19.9	21.5	19.3	20.6	19.7	22.3	20.3	20.2	18.6
P018	17.3	18.8	18.1	21.0	19.8	21.1	22.6	12.8	19.2	19.6
P102	23.4	21.6	20.6	18.2	19.3	22.0	22.5	18.3	20.7	18.5
P115	19.5	19.8	18.3	16.9	16.5	16.6	17.9	17.7	15.6	20.2
P136	20.4	22.1	20.5	18.5	18.8	18.9	19.2	19.5	18.8	18.4
P137	16.5	20.9	20.2	14.6	17.1	13.9	20.7	19.0	18.4	19.1
P235	19.6	19.2	21.5	20.1	21.1	18.7	21.4	20.6	20.2	17.9
P302	22.2	22.1	21.0	19.9	20.9	22.2	21.4	21.0	17.9	22.2
P325	19.6	18.8	20.0	21.6	19.4	20.3	19.1	18.0	19.8	18.5
P348	18.0	11.2	20.8	13.9	22.0	18.5	18.8	18.1	16.7	18.6
P373	20.6	21.1	25.0	20.5	22.1	19.4	21.7	19.7	12.6	17.1
P422K	21.5	20.0	18.9	21.5	19.5	17.0	20.6	19.5	19.5	18.6
P433S	17.6	18.6	19.9	18.1	19.5	19.7	18.5	20.7	21.8	19.4

Table E2 The impact resistance of 3 mm selected colored samples with 0.038% ADVN polymerized at 60°C and annealed at 120°C

	1	2	3	4	5	6	7	8	9	10
P000	18.3	20.0	16.4	18.7	21.1	-	-	-	-	-
P018	18.9	20.5	21.6	21.5	21.0	18.5	20.9	19.6	19.4	16.7
P102	20.8	21.6	18.8	19.3	20.7	-	-	-	-	-
P115	18.8	14.7	19.4	16.8	18.0	15.7	18.2	17.2	16.0	18.9
P136	18.2	18.8	16.8	18.9	18.1	15.6	17.4	16.0	17.2	18.4
P137	21.5	16.5	21.4	22.0	20.5	20.9	19.6	20.3	20.4	21.1
P202	21.5	17.1	18.2	21.0	16.2	19.0	19.5	20.9	19.8	-
P212	23.4	16.7	22.0	14.5	18.7	21.5	22.7	22.3	22.2	18.5
P235	20.4	18.6	19.1	17.3	19.6	19.0	20.0	17.7	17.5	14.5
P302	16.9	19.6	18.7	20.4	21.4	20.0	19.5	20.5	22.0	18.9
P327	15.0	19.5	18.4	15.9	17.5	-	-	-	-	-
P348	15.7	17.5	15.6	19.2	18.8	-	-	-	-	-
P373	21.6	17.3	21.0	20.2	19.7	-	-	-	-	-
P402	19.7	18.3	19.0	18.1	17.4	17.0	17.5	17.8	15.2	-
P422K	17.4	15.5	18.8	18.3	19.9	-	-	-	-	-
P433S	16.9	18.5	19.2	22.7	17.0	-	-	-	-	-
P502	19.4	18.2	21.5	18.3	18.9	19.3	16.9	17.2	22.4	16.6
P522	17.2	23.3	21.4	-	14.5	16.1	17.9	26.3	22.2	17.5
P531	21.6	19.9	19.9	22.5	20.3	16.0	14.9	21.2	23.9	-
P814	18.8	14.2	15.4	16.0	17.1	19.6	20.3	-	-	-
P993	13.8	14.7	19.5	16.7	-	18.9	-	26.1	21.0	19.7

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