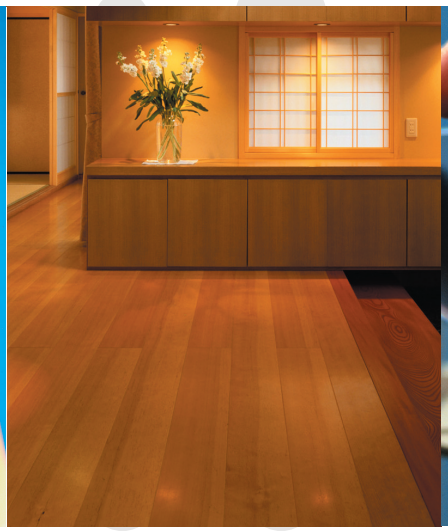
Ciba Specialty Chemicals

Ciba

Photoinitiators for UV Curing

Key Products Selection Guide 2003

Coating Effects

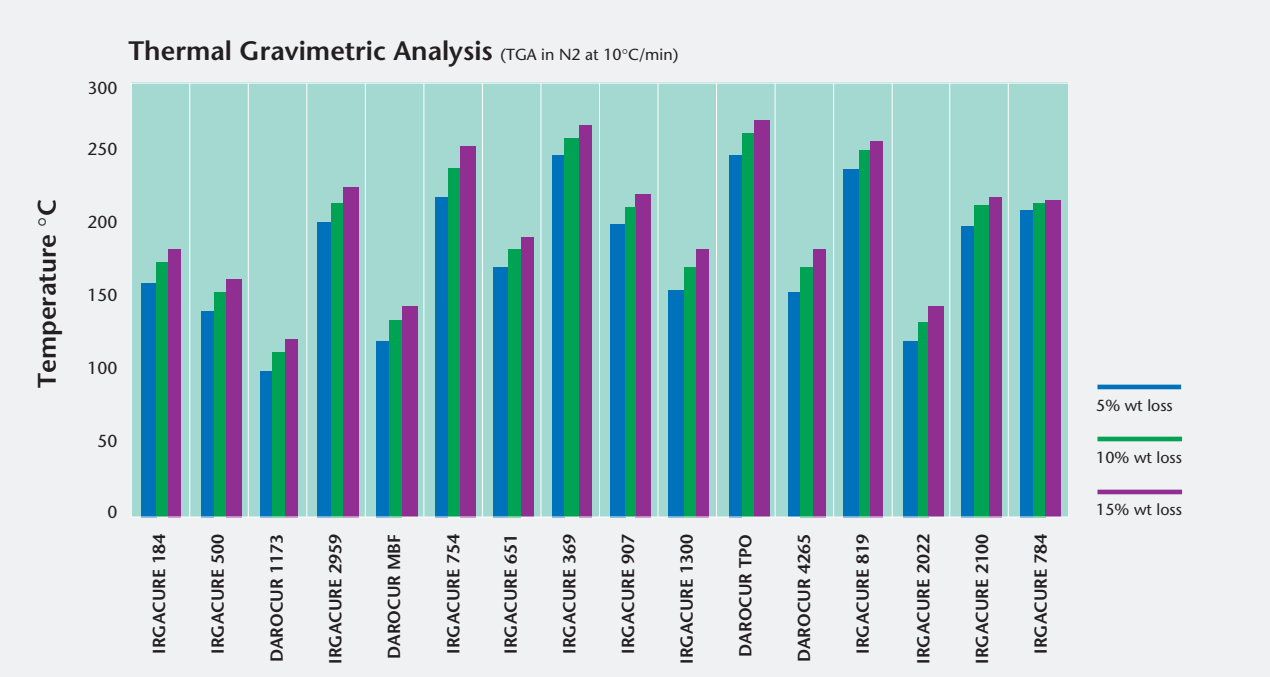
Value beyond chemistry

Typical physical properties Photoinitiators	Chemical class	Chemical identity	Appearance	Freezing point (FP, °C) Melting point (MP, °C) Boiling point (BP, °C)	Specific gravity (water = 1)	UV/VIS Absorption peaks (nm) in methanol
IRGACURE 184	α-Hydroxyketone	1-Hydroxy-cyclohexyl-phenyl-ketone	white to off-white crystalline powder	MP 45–49 °C	1.1–1.2	246, 280, 333
IRGACURE 500	α-Hydroxyketone	IRGACURE 184 (50 wt%), Benzophenone (50 wt%)	clear, pale yellow liquid	FP<0 °C recrystallization below 18 °C	1.1	250, 332
DAROCUR 1173	α-Hydroxyketone	2-Hydroxy-2-methyl-1-phenyl-1-propanone	clear, light yellow liquid	liquid at room temp. MP 4°C, BP 80–81 °C	1.1	245, 280, 331
IRGACURE 2959	α-Hydroxyketone	2-Hydroxy-1-[4-(2-hydroxyethoxy) phenyl]-2-methyl-1-propanone	off-white powder	MP 86–90 °C	1.3	276
DAROCUR MBF	Phenylglyoxylate	Methylbenzoylformate	clear liquid	liquid at room temp. MP 17 °C BP 246–248 °C	1.2	255, 325
IRGACURE 754	Phenylglyoxylate	oxy-phenyl-acetic acid 2-[2 oxo-2 phenyl-acetoxy-ethoxy]-ethyl ester and oxy-phenyl-acetic 2-[2-hydroxy-ethoxy]-ethyl ester	light yellow liquid	liquid at room temp. MP < -22 °C	1.2	255, 325
IRGACURE 651	Benzyldimethyl-ketal	Alpha, alpha-dimethoxy-alpha-phenylacetophenone	white to light yellow powder	MP 64–67 °C	1.2	250, 340
IRGACURE 369	α-Aminoketone	2-Benzyl-2-(dimethylamino)-1-[4-(4-morpholinyl) phenyl]-1-butanone	slightly yellow powder	MP 110–114 °C	1.2	233, 324
IRGACURE 907	α-Aminoketone	2-Methyl-1-[4-(methylthio)phenyl] -2-(4-morpholinyl)-1-propanone	white to light beige powder	MP 70–75 °C	1.2	230, 304
IRGACURE 1300	α-Aminoketone	IRGACURE 369 (30 wt%) + IRGACURE 651 (70 wt%)	light yellow powder	MP 55–60 °C	1.2	251, 323
DAROCUR TPO	Mono Acyl Phosphine (MAPO)	Diphenyl (2,4,6-trimethylbenzoyl)-phosphine oxide	light yellow powder	MP 88–92 °C	1.2	295, 368, 380, 393
DAROCUR 4265	MAPO/ α-Hydroxyketone	DAROCUR TPO (50 wt%) + DAROCUR 1173 (50 wt%)	light yellow viscous liquid	liquid at room temp.	1.1	240, 272, 380
IRGACURE 819	Bis Acyl Phosphine (BAPO)	Phosphine oxide, phenyl bis (2,4,6-trimethyl benzoyl)	light yellow powder	MP 127–133 °C	1.2	295, 370
IRGACURE 819DW	BAPO Dispersion	IRGACURE 819 (45% active) dispersed in water	light yellow liquid	liquid dispersion at room temp.	1.1	295, 370
IRGACURE 2022	BAPO/ α-Hydroxyketone	IRGACURE 819 (20 wt%) + DAROCUR 1173 (80 wt%)	light yellow liquid	liquid at room temp.	1.1	246, 282, 370
IRGACURE 2100	Phosphine oxide	–	light yellow viscous liquid	liquid at room temp.	1.1	275, 370
IRGACURE 784	Metallocene	Bis (eta 5-2,4-cyclopentadien-1-yl) Bis [2,6-difluoro-3-(1H-pyrrol-1-yl) phenyl]titanium	orange powder	MP 160–170 °C	> 1	398, 470
IRGACURE 250	Iodonium salt	Iodonium, (4-methylphenyl) [4-(2-methylpropyl) phenyl]-, hexafluorophosphate(1-)	yellow to brownish liquid	75% solution liquid at room temp. Storage below 30°C.	1.5	242

Photoinitiator (Solubility, Weight %)	Acetone	n-Butyl Acetate	IBOA	IDA	PEA	HDDA	TrPGDA	TMPTA	TMPEOTA	DAROCUR 1173
IRGACURE 184	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50
IRGACURE 500	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50
DAROCUR 1173	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	
IRGACURE 2959	19	3	5	5	5	10	20	5	5	35
DAROCUR MBF	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50
IRGACURE 754	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50
IRGACURE 651	> 50	> 50	40	30	> 50	40	25	> 50	45	> 50
IRGACURE 369	17	11	10	5	15	10	6	5	5	25
IRGACURE 907	> 50	35	35	25	45	35	22	25	20	> 50
IRGACURE 1300	> 50	45	> 50	35	> 50	> 50	35	25	25	> 50
DAROCUR TPO	47	25	15	7	34	22	16	14	13	> 50
DAROCUR 4265	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50
IRGACURE 819	14	6	5	5	15	5	5	5	> 5	30
IRGACURE 2022	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50
IRGACURE 2100	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50
IRGACURE 784	30	10	5	NA	15	10	5	5	NA	7

IBOA = isobornyl acrylate; **IDA** = isodecyl acrylate; **PEA** = 2-phenoxyethyl acrylate; **HDDA** = hexane diol diacrylate; **TrPGDA** = tripropyleneglycol diacrylate; **TMPTA** = trimethyolpropane triacrylate; **TMPEOTA** = trimethyolpropane ethoxytriacrylate.

Note: the solid photoinitiators were dissolved in liquid monomers (by weight ratio), heated in oven (50–60°C) and mixed. Samples were then kept at room temperature for 24 hours. If no recrystallization occurred, results were then recorded. Only 5% increments of photoinitiators were employed in the study. For example the solubility of IRGACURE 907 in IBOA is 35% which means that its solubility is above 35% but below 40%.

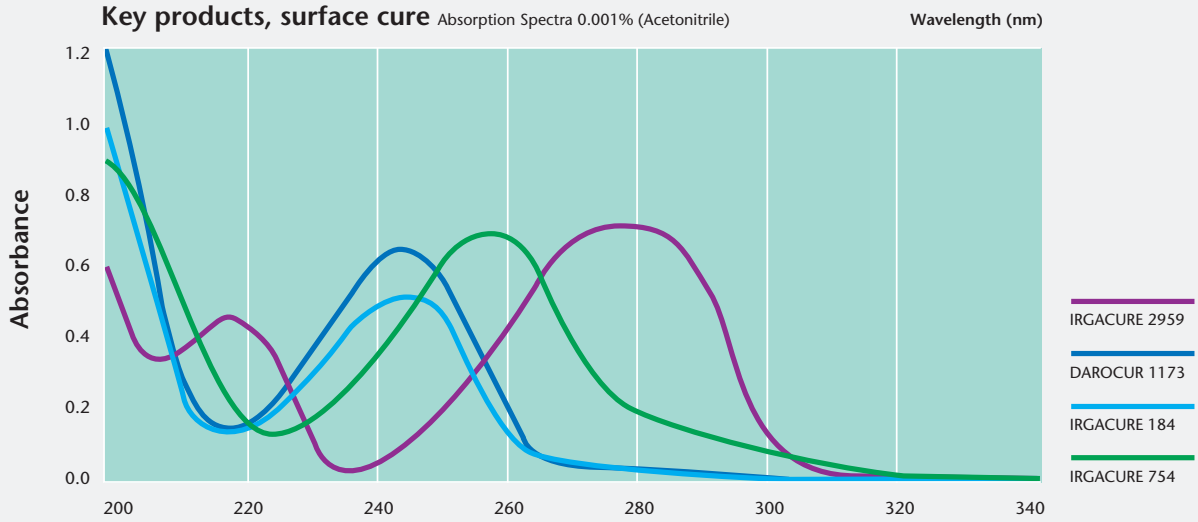


UV Curing Applications	IRGACURE 184	IRGACURE 500	IRGACURE 754	DAROCUR 1173	IRGACURE 2959	DAROCUR MBF	IRGACURE 651	IRGACURE 369	IRGACURE 907	IRGACURE 1300	DAROCUR TPO	DAROCUR 4265	IRGACURE 819	IRGACURE 819 DW	IRGACURE 2022	IRGACURE 2100	IRGACURE 784	IRGACURE 250
	Surface cure, co-initiator for pigment systems							Through cure, pigmented systems										
UPES Wood Top and Intermediate Coat	●	❍		❍			●				●		●		●	●		
Acrylated Wood Top and Intermediate Coat	●	●	●	●	❍	❍							❍		●	●		
Wood Fillers	❍			❍			●				❍	❍	●		❍	●		
Clear Top Coats on Plastic and Metal	●	❍	●	❍	❍	❍												❍
Pigmented Top Coats on Plastic and Metal	●	❍	●	●	❍	❍					❍	❍	●	●	●	●		●
UV Powder Coatings					●		❍						●					
Dispersions for Facades		●	❍											❍				
Adhesives	●			❍	●		❍	❍			❍	❍	●		❍	❍		●
Glass Fiber Composites	●						❍				❍		●		●			
Gel Coats	●						❍				❍		●		●			
Etch Resists for PCB							●	●	●				❍				●	
Solder Masks							❍	●	●				❍				●	
Epoxy Resists																		❍
Flexo Printing Plates							●	❍					❍					
Laser Direct Imaging Offset Printing Plates																	●	
Offset Inks	❍			❍	❍			●	●	●	❍	❍	●		●	●		
Screen Inks	●			❍	❍			●	●	❍	❍	❍	●		●	●		●
Flexo Inks Inkjet Inks	❍			❍	❍			●	●	●	❍	❍	●		●	●		●
Over Print Varnishes	●	●	●	●	●	❍							❍					❍
Cationic Polymerization																		●
Thick Sections Polymerization											❍	❍	●		●			❍
UV Stabilized Clear Coatings	●		●	❍	❍	❍					❍	❍	●	●	●	●		
Water-based UV Formulations		●	●	❍	●	❍								●	❍	❍		
Xi- and Xn-free Applications	●				●	●	●	●		●								
Low Volatility, Low Odor			●		●			●					●	●		●		

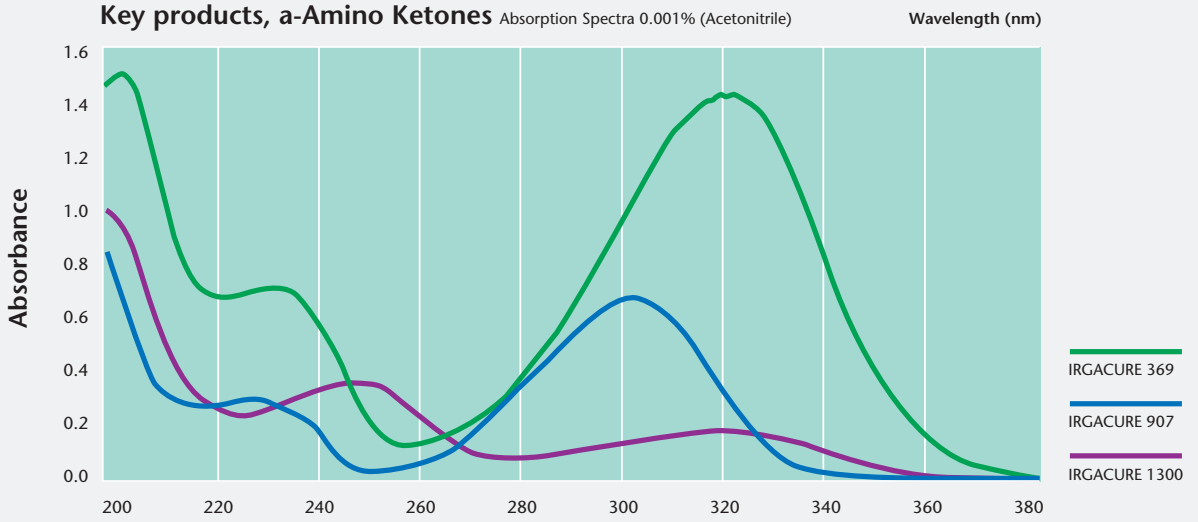
● recommended application

❍ possible application

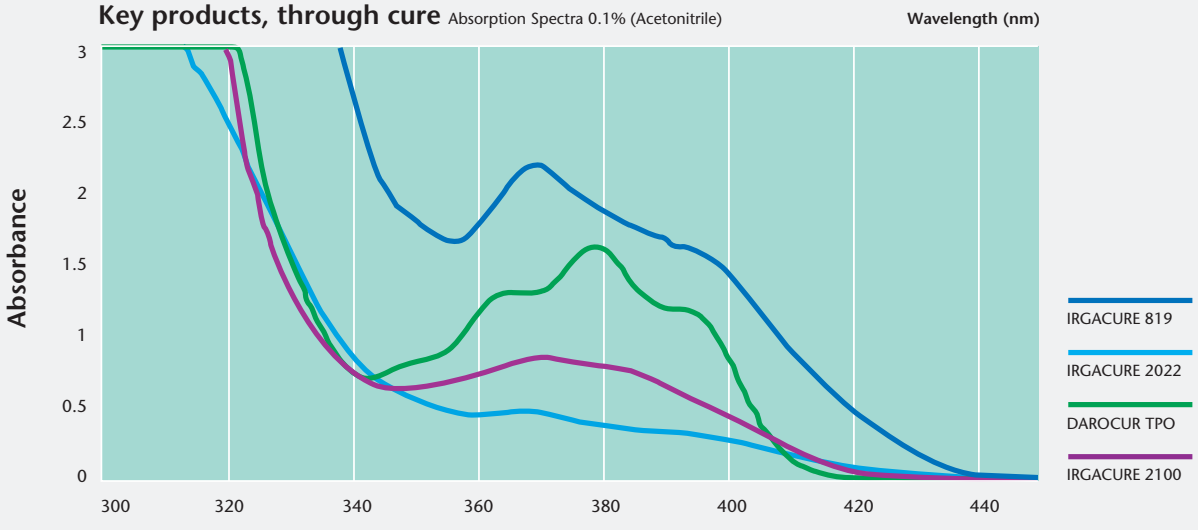
Key products, surface cure Absorption Spectra 0.001% (Acetonitrile)

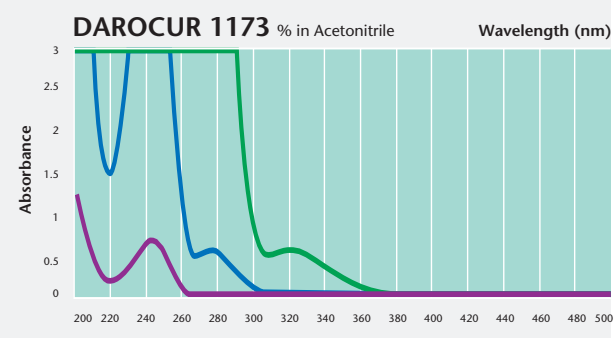


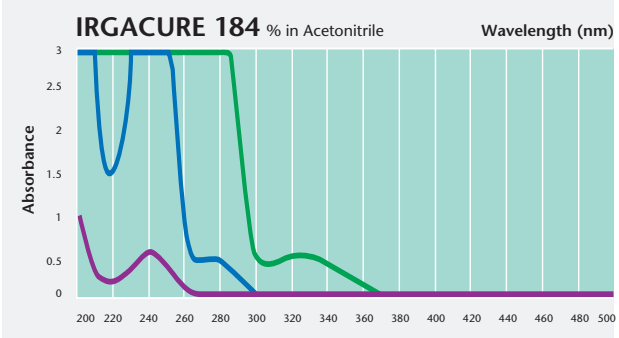
Key products, a-Amino Ketones Absorption Spectra 0.001% (Acetonitrile)

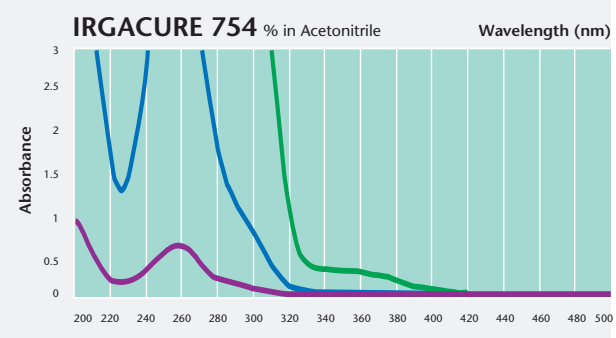


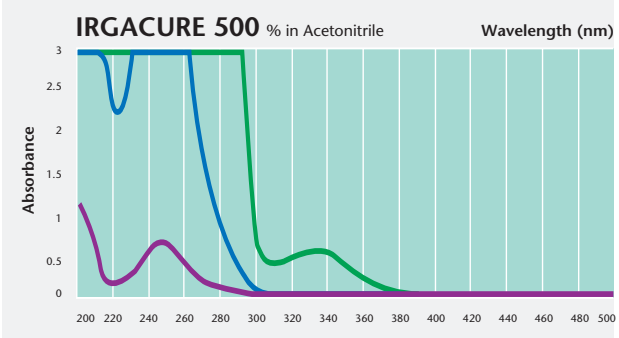
Key products, through cure Absorption Spectra 0.1% (Acetonitrile)

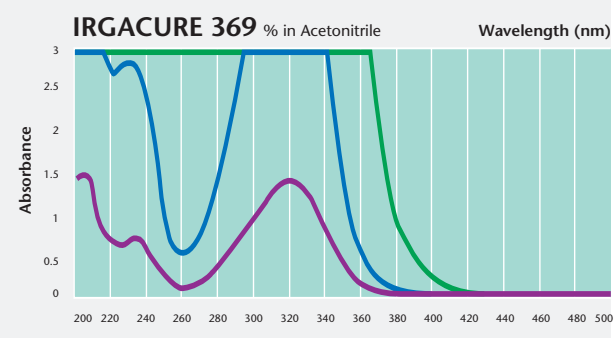


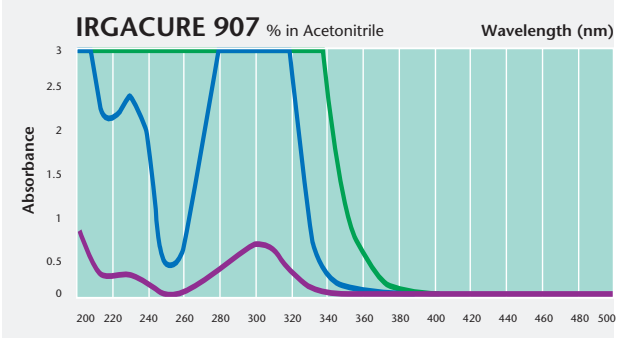


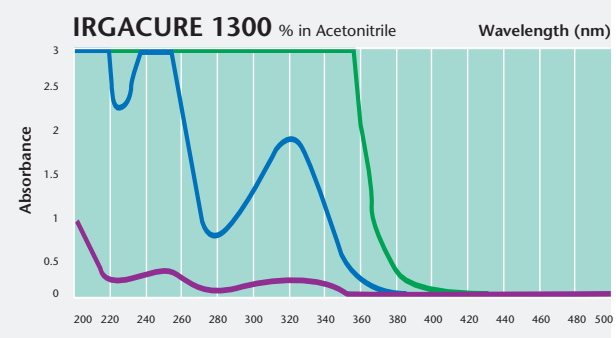


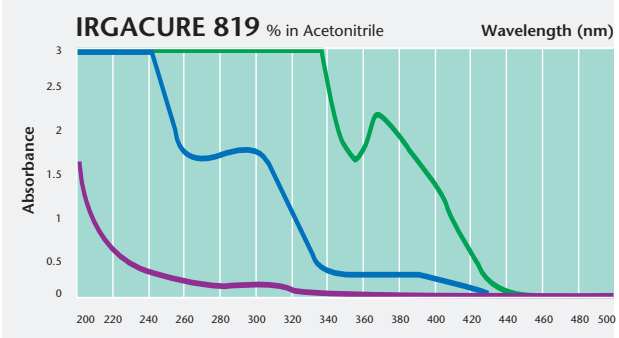


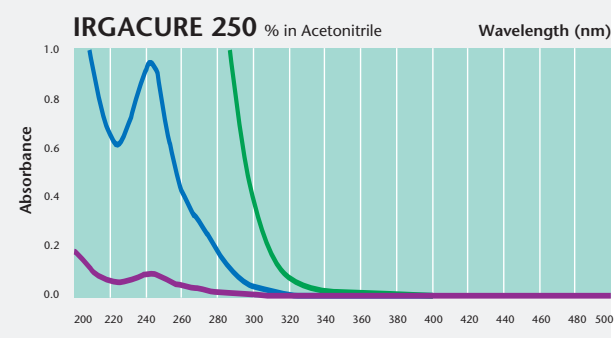


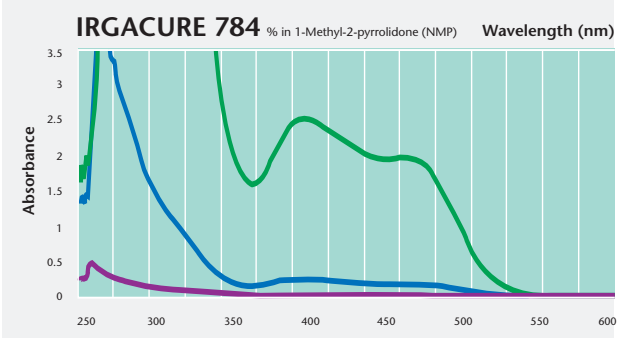








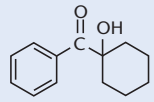




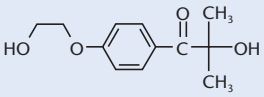
0.10 0.010 0.001

Chemical Structures

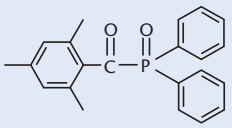
IRGACURE 184



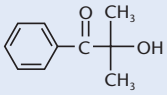
IRGACURE 2959



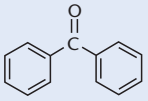
DAROCUR TPO



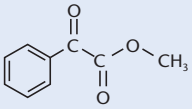
DAROCUR 1173



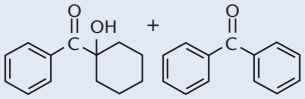
DAROCUR BP



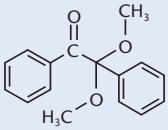
DAROCUR MBF



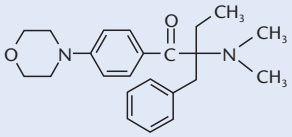
IRGACURE 500



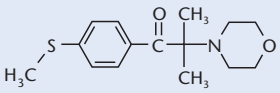
IRGACURE 651



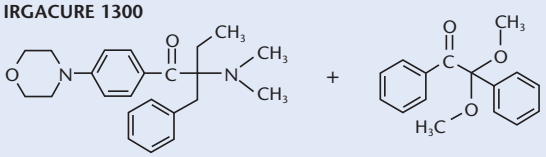
IRGACURE 369



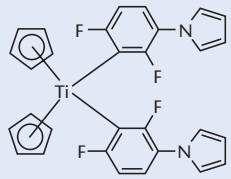
IRGACURE 907



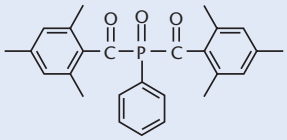
IRGACURE 1300



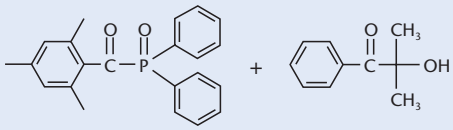
IRGACURE 784



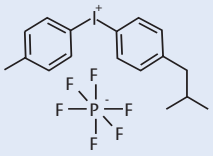
IRGACURE 819 and IRGACURE 819 DW



DAROCUR 4265



IRGACURE 250



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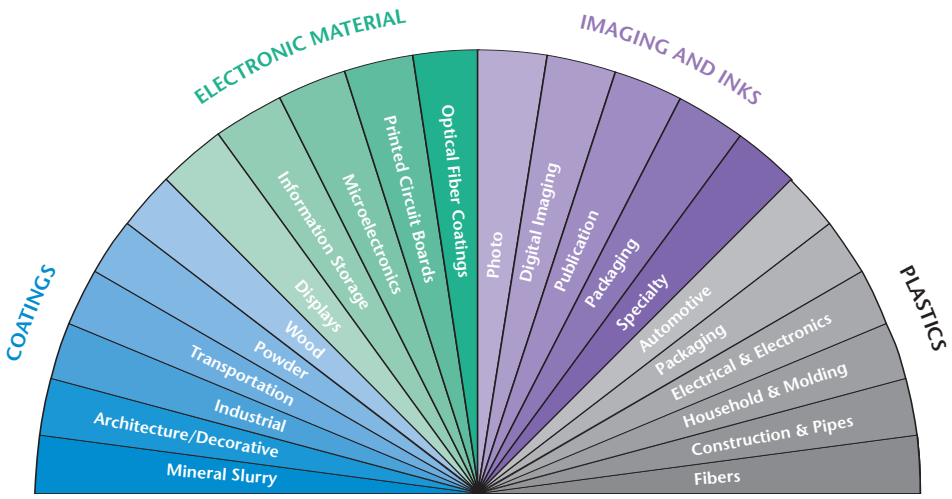

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Value beyond chemistry