

CYTEC

Surface Specialties



STARTING FORMULATIONS
for UV INKS
and OVERPRINT VARNISHES

EBECRYL[®] resins

and ADDITOL[®] additives

for Graphic Arts

CONTENT

1. UV offset ink starting formulations

- 1.1. for Paper and Boardpage 1
- 1.2. for Plastics (and metals)page 1

2. UV flexo ink starting formulations

- 2.1. for Paper and Boardpage 4
- 2.2. for adhesion to difficult substratespage 5

3. UV screen ink starting formulations

- 3.1. On paperpage 7
- 3.2. Water dilutable formulation on paper (posters)page 7
- 3.3. On PVC (Polyvinylchloride)page 7
- 3.4. On PE (Polyethylene)page 8
- 3.5. On PP (Polypropylene)page 9
- 3.6. On PS (Polystyrene)page 9
- 3.7. On Polyesterpage 9
- 3.8. On PET Bottlespage 10
- 3.9. On PC (Polycarbonate)page 10

5. UV Inkjet ink starting formulationspage 11

4. UV OPV starting formulations

- 4.1 For paper and boardpage 12
- 4.2 For plasticspage 12

1. UV offset ink starting formulations:

1.3. for Paper and Board:

Product	Yellow	Magenta	Cyan	Black	
Ebecryl™657	25	22	24	18	
Ebecryl 3420	40	37	36	40.5	
OTA480	2	4	2	3	
Stabilizer Additol S120	1	1	1	1	
Special Black 250 (Degussa)				19	
Irgalite blue GLO (Ciba)			17		
Irgalite Red SMA (Ciba)		18			
Permanent yellow DGR (Clariant)	14				
PB61:1				1.5	
PO34	0,1				
Talc	5	5	6	3	Grind
Photoinitiator blend ⁽¹⁾	8	8	9	10	
Rad-Wax 62EB (Kromachem)	1	1	1	1	Mix
OTA480	4	4	4	4	Viscosity adjustment
Total	100	100	100	100	

Remark: PO34 in yellow should preferably be added as a concentrated paste in the second part of the formulation.

1.4. for Plastics (and metals):

Product	Yellow	Magenta	Cyan	Black	
Ebecryl™436 or Ebecryl™446	36	35	41	35	
Ebecryl 220	20	20	20	20	
TMPTA	5	6	-	4	
Stabilizer Additol S120	1	1	1	1	
Special Black 250 (Degussa)				19	
Irgalite blue GLO (Ciba)			17		
Irgalite Red SMA (Ciba)		18			
Permanent yellow DGR (Clariant)	14				
PB61:1				1.5	
PO34	0,1				
Talc	5	5	6	3	Grind
Photoinitiator blend ⁽¹⁾	8	8	9	10	
Rad-Wax 62EB (Kromachem)	2	2	2	2	
Ebecryl®350	0.5	0.5	0.5	0.5	Mix
TMPTA	5	4.5	4	4	Viscosity adjustment
Total	100	100	100	100	

⁽¹⁾ PI Blend : 14 % BP, 34 % BDK, Irgacure 369^(*) 7 %, ITX 13 %, EPD 32 % (*Ciba)

If necessary, for improvement of ink water balance, about 10% of Ebecryl®436 can be replaced by Ebecryl®870.

2. UV flexo ink starting formulations:

2.3. for Paper and Board:

Pigment pastes	Yellow	Magenta	Cyan	Black
Ebecryl™ 450	66.4	60	60	
Ebecryl 3420				54
Solsperse 32000	2	4	3	5
Solsperse 5000			1	
Solsperse 22000	0.6			
Additol S120	1	1	1	1
Permanent Yellow DGR (Clariant)	30			
Sunbrite 219-0203 (4BY) (SUN)		35		
Irgalite blue GLO (Ciba)			35	
Special black 250 (Degussa)				40
Total	100	100	100	100

Inks	Yellow	Magenta	Cyan	Black
% pigment in the ink	14%	16%	16%	18%
Yellow paste	46			
Magenta paste		46		
Cyan paste			46	
Black paste				45
Ebecryl 160	45	45	45	
Ebecryl 40				44.5
Modaflow 2100	1	1	1	1
PBZ	3	3	3	3
EPD	5	5	5	5
Irgacure 369 (Ciba)				1.5
Total	100	100	100	100

Note: Formulations given here are based on pigment concentrations used on the market. These inks are designed to be printed with anilox delivering 1.3gr/m² and achieving the standard optical densities of prints. (1.25 for yellow; 1.4 for magenta and cyan and 1.8 for black). The black ink has been intentionally formulated as a monopigmented one, which is not the market reality, the difference being only about 1% of alkali blue pigment.

2.4. for adhesion to difficult substrates:

Pigment pastes (1)	Yellow	Magenta	Cyan	Black
Ebecryl™ 450	19.5	19	19	
Ebecryl™ 3420				27
TMPTA	38	36	34	27
Solsperse 39000	4			
Solsperse 32000		4	5	5
Solsperse 5000			1	
Solsperse 22000	1.5			
Additol S120	1	1	1	1
Permanent Yellow DGR (Clariant)	35			
Sunbrite 219-0203 (4BY)- (SUN)		40		
Irgalite blue GLO (Ciba)			40	
Special black 250 (Degussa)				40
Total	100	100	100	100

Pigment pastes (2)	Yellow	Magenta	Cyan	Black
Ebecryl™ 140	57.5	55	53	
Ebecryl™ 3420				27
TMPTA				27
Solsperse 39000	4			
Solsperse 32000		4	5	5
Solsperse 5000			1	
Solsperse 22000	1.5			
Additol S120	1	1	1	1
Permanent Yellow DGR (Clariant)	35			
Sunbrite 219-0203 (4BY)- (SUN)		40		
Irgalite blue GLO (Ciba)			40	
Special black 250 (Degussa)				40
Total	100	100	100	100

Inks	Yellow	Magenta	Cyan	black
% pigment in the ink	14%	16%	16%	18%
Formulation				
Pigment paste	40	40	40	45
Ebecryl 7100	20	20	20	20
TMPTA	31	31	31	29.5
Modaflow 2100	1	1	1	1
ITX (or PBZ if ITX should not be used)	3	3	3	3
EPD	5	5	5	5
Irgacure 369 (Ciba)				1.5
Total	100	100	100	100

Notes:

With this formulation the pigment paste is ground using a three roll mill. This pigment paste is then formulated with the diluents and photo initiators shown in order to produce an ink. These are starting point formulations, some adjustment will be required in order to optimize these formulations for a specific application.

The viscosity required is around 500- 700 mPa.s at 2500 sec⁻¹.

An amount of HDDA (< 10%) may used. It should also help to improve adhesion but will lead to a slower cure speed.

The photo initiator levels can be altered in order to change the cure speed.

The pigment levels proposed here give standard optical densities of 1.25 for yellow, 1.40 for magenta and cyan, 1.80 for black at a coat weight of 1.0 to 1.25 g/m².

It is possible to improve the appearance of the black ink by adding a small amount of blue to it.

3. UV screen ink starting formulations:

Screen inks are being used on a wide variety of substrates.

3.1. On paper

Raw materials	Parts
Ebecryl 605	50
Ebecryl 7100	10
TPGDA	16
PI	5
Aerosil 200	2
Pigment paste	20

3.2. Water dilutable formulation on paper (posters)

Raw materials	Parts	Pigment paste	
Ebecryl™ 2003	30	Ebecryl™ 2003	35
Ebecryl™ 11	5	Ebecryl™ 2047	50
Ebecryl™ 12	10	Pigment	15
Water	15		
PI	5		
Additol VXL 4951	0.5		
Aerosil 200	2		
Pigment paste	40		

3.3. On PVC (Polyvinylchloride)

OPV		Ink	
Raw materials	Parts	Raw materials	Parts
Ebecryl™ 605	40	Pigment paste	20
Ebecryl™ 584	15	Ebecryl™ 584	30
Ebecryl™ 210	8	Ebecryl™ 7100	15
Ebecryl™ 81	15	Ebecryl™ 303	20
HDDA	10	Ebecryl™ 1039	5
PI	5	VCL	5
Additol VXL 4951	2	PI	5
		Additol VXL 4951	0.5

3.4. On PE (Polyethylene)

On flexible PE (packaging)

Ink:

Raw Materials	Parts	Pigment paste	
Pigment paste	20		
Ebecryl™ 5129	24	Ebecryl™ 745	40
Ebecryl™ 7100	24	TMPTA	30
HDDA	24	Pigment	30
PI	5		
Additol VXL 4951	1		
Aerosil 200	1		

On hard PE (bottles, cosmetics,.....)

Raw Materials	Parts	Pigment paste	
Pigment paste	25	Ebecryl™ 745	40
Ebecryl™ 220	25	TMPTA	30
Ebecryl™ 7100	12	Pigment	30
HDDA	11		
Ebecryl™ 1039	8		
DPGDA	10		
PI	4		
Additol VXL 4951	1		
Wax	3		

3.5. On PP (Polypropylene)

Raw Materials	Parts	Pigment paste	
Ebecryl™ 586	32	Ebecryl™ 745	40
Ebecryl™ 7100	8	TMPTA	30
DPGDA	36	Pigment	30
TMPTA	6		
PI	4		
Silicone	1		
Pigment paste	20		

On PP buckets or hard PP

Raw Materials	Parts	Pigment paste	
Ebecryl™ 745	23	Ebecryl™ 745	40
Ebecryl™ 303	17	TMPTA	30
PETIA	10	Pigment	30
PI	5		
Additol VXL 4951	0.5		
Silicone	2		
Pigment paste	15		

3.6. On PS (Polystyrene)

Raw Materials	Parts	Pigment paste	
Ebecryl™ 745	20.5	Ebecryl™ 745	40
Ebecryl™ 7100	15	TMPTA	30
IBOA	10	Pigment	30
Ebecryl™ 303	25		
PI	6.5		
Additol VXL 4951	3		
Pigment paste	20		

3.7. On Polyester

Raw Materials	Parts
Ebecryl™ 5129	28
PETIA	47
HDDA	19
PI	4
Additol VXL 4951	0.5
Silicone	1

3.8. On PET Bottles

Raw Materials	Parts
Ebecryl™ 745	37
HDDA	17
NVP	10
PI	5
Additol VXL 4951	1
Pigment paste	30

3.9. On PC (Polycarbonate)

Raw Materials	Parts	Pigment paste
Ebecryl™ 294	15	PETIA 30
Ebecryl™ 220	6.5	Pigment 70
PETIA	34	
NMP	16	
PI	5	
Additol VXL 4951	0.5	
Pigment paste	20	

Photoinitiator blend (PI):	ITX:	13%
	EPD:	14%
	BZP:	13%
	BDK:	40%
	Irgacure 369:	20%

5. UV Inkjet ink starting formulations:

Pigment pastes:

	Yellow	Magenta	Cyan	Black
Ebecryl™ 151	68.4	69	67.8	69
Additol™ S 120	1.0	1.0	1.0	1.0
Solsperse* 22000	0.6			
Solsperse 5000			1.2	
Solsperse 39000	5.0	5.0	5.0	5.0
Yellow pigment	25.0			
Blue pigment			25.0	
Red pigment		25.0		
SB250 (Degussa)				25.0
Total	100	100	100	100

Suggested formulation for ink

	Yellow	Magenta	Cyan	Black
Pigment paste	20	20	20	20
DPGDA	41	41	41	41
HDDA	15	15	15	15
Ebecryl™ 1039	15	15	15	15
PBZ	3	3	3	3
EPD	5	5	5	5
Irgacure 369 (Ciba)	1	1	1	1
Total	100	100	100	100

Ebecryl™ 151 : grinding resin
 DPGDA : base diluent
 HDDA : improve adhesion to plastics
 Ebecryl™ 1039 : improve flexibility

Important remark: There is currently a lot of patent literature published and care must be taken not to infringe any of these patents.

5. UV OPV starting formulations:

5.1 For paper and board:

Ebecryl™ 6040	: 36%
DPGDA	: 43%
Ebecryl 7100	: 15%
Benzophenone	: 4%
CPK	: 1%
Ebecryl 350	: 1%

5.2 For plastics:

PVC:

Ebecryl 584	: 50%
HDDA	: 35 %
Ebecryl 7100	: 10%
BCPK	: 4%
Ebecryl 1360	: 1%

PE film

Ebecryl™ 40	: 40%
Ebecryl 145	: 10%
Ebecryl 5129	: 10%
Ebecryl 8402	: 5%
Ebecryl 2001	: 3%
Ebecryl 3420	: 10%
Benzophenone	: 5%
CPK	: 2%
Ebecryl 7100	: 15%