

QUALITY SHINES.



Unlimited colors

Colorants for plastics

X Bayplast® X Macrolex®

QUALITY WORKS.

LANXESS
Energizing Chemistry

MACROLEX® DYES – PRODUCT RANGE AND PROPERTIES

The LANXESS Polymer Additives business unit supplies a broad range of colorants for a wide range of different applications.

Outstanding product quality, long-established technical expertise and the satisfaction of a wide range of essential regulatory requirements – these are the defining features of our product portfolio.

The following pages give technical information on Lanxess colorants used for plastics.

- **Macrolex®** soluble dyestuffs are used for engineering plastics.
- **Bayplast®** organic pigments are used for standard plastics.

The **Macrolex®** product range includes dyestuffs which are classified as disperse or solvent dyes.

Some dyes have a high solubility in solvents like **Macrolex® Yellow 6G**, others like **Macrolex® Red EG** show very low solubility. In all cases **Macrolex®** dyes are fully soluble in hot engineering plastics.

In contrast to standard disperse dyes, **Macrolex®** dyes are extremely pure and have a very low amount of impurities.

As early as in the 1960s **Macrolex®** dyes were developed for the special needs of plastics coloration. Process conditions for engineering plastics like polystyrene, ABS, PC, PMMA, PA and others are quite severe. During extrusion and injection molding of PC, the dyes have to withstand temperatures up to over 350°C for some minutes. Only selected dyes show the chemical resistance necessary.

Chemical stability also leads to long lasting final products which have to withstand sunlight and weather. For example red car taillights will last as long as the car itself without losing their bright red color. To achieve this, the right transparent polymers and dyes have to be used.



■ Fully transparent chips made with Macrolex® dyes.

MACROLEX® DYES – PRODUCT RANGE AND PROPERTIES

Usage:

Macrolex® dyes are suitable for coloring amorphous thermoplastics such as:

- PS, EPS, SB*, SAN*, ABS and their blends (*not block copolymers);
- PMMA, PC, PPO and their blends;
- PVC-U, PET, (PBT);
- (PA-6, PA-12), CA, CAB.

The Macrolex® range contains soluble dyes with

- high heat stability;
- good light fastness and weather resistance;
- high color strength;
- outstanding brilliance;
- high purity, safe to use for food and toys.

In chemical terms, the dyes belong to various classes. For the coloring of plastics, the heat stability of the colorant is one of the key selection criteria. The data given in the tables on heat stability and light fastness are guide values and not physical constants. They are dependent on the relevant substrate and the concentration used and must be tested in each individual case.

Soluble dyes are not recommended for coloring crystalline systems such as:

- HDPE, LDPE, PP;
- thermoplastics containing plasticizers, e.g. flexible PVC and flexibilized cellulose esters.

For these polymers Bayplast® pigments are suitable

The transparent coloring of glass-clear plastics is only possible with soluble dyes. For opaque coloring, the Macrolex® dyes have to be combined with opaque inorganic pigments such as:

- titanium dioxide;
- iron oxide pigments;
- Bayplast® pigments.

Macrolex® dyes dissolve completely in the plastics melt at the respective processing temperatures of the thermoplastic. In practical application, this means:

- maximum color yield;
- high reproducibility of color formulations; irrespective of the dispersing speed of the equipment used.



MACROLEX® DYES – PRODUCT RANGE AND PROPERTIES

Macrolex® dyes are soluble in organic solvents, e.g. aromatics, esters, chlorinated hydrocarbons. They are insoluble in water and dilute aqueous solutions of acetic acid or alcohol. Not being soluble in water and alcohol is important for use in consumer goods, food packaging and children's toys made of colored plastics, because the dye cannot bleed into the respective media. Migration must be checked in each individual case whenever there may be contact with printing inks and coatings based on organic solvents.

Macrolex® dyes should be treated like organic pigments when coloring thermoplastics. Thorough mixing and dispersion plus high processing temperatures encourage the dissolving of the dyes.

Where dyes with low solubility and high melting point are used, e.g. Macrolex® Red EG, particular attention should be paid to thorough mixing and dispersion before the plastification stage.

Some dyes, e.g. Macrolex® Orange 3G, tend to sublime at high processing temperatures.

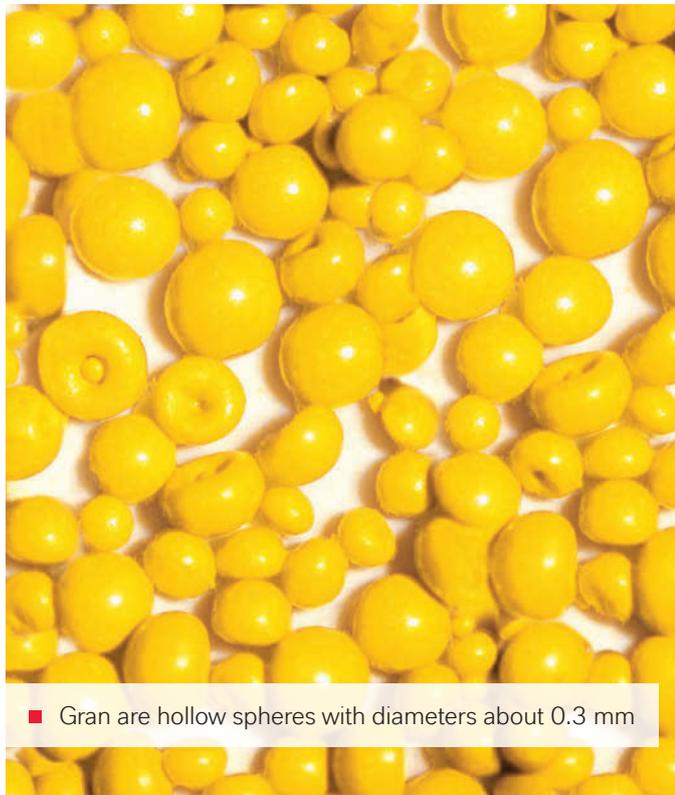
They can be replaced by other dyes with better fastness to sublimation, such as Macrolex® Red EG, Macrolex® Red E2G and Macrolex® Orange R. For electronic parts produced by two-component molding of polymers, dyes like Macrolex® Yellow E2R are recommended.

Macrolex® dyes comply with the current regulations worldwide concerning dyes for use in:

- food packaging;
- food contact applications;
- children's toys made of plastic.



WE HAVE REVOLUTIONIZED DYES: MACROLEX® GRAN



■ Gran are hollow spheres with diameters about 0.3 mm

A new era in coloring plastics has begun with Macrolex®, one of the first microgranulated dyes ever. It is

- efficient;
- cost-effective;
- easier to process than powder dyes;
- and leads to very low dusting.

The outstanding properties of Macrolex® have been combined with a granular form, making LANXESS one of the few manufacturers in the world to achieve an all-round improvement in the quality of high-grade dyes.

Outstanding properties

Thanks to its unique consistency Macrolex® saves both time and money. Macrolex® guarantees maximum color quality and outstanding properties.

Exact metering

Macrolex® has better flow properties than any powder dye and can therefore be metered more exactly. Macrolex® is the ideal dye for automatic weighing and continuous manufacturing processes.

Easier to process

Macrolex® has better solubility and is therefore easier to process. The microgranules are dispersed quickly, evenly and completely.

Safe

The high purity of Macrolex® dyes provides improved safety in children's toys and packaging for cosmetics and foods.

Virtually no residues

The microfine Macrolex® particles have very good flow properties that allow containers to be emptied almost completely before disposal. Production units are much easier to clean.

Very low dust formation

Macrolex® generates considerably less dust than powder dyes. Handling is therefore much cleaner and more environmentally friendly and has a lower impact on health.

Reduced capacities

On account of its lower volume, Macrolex® is more economic to store, transport and process.

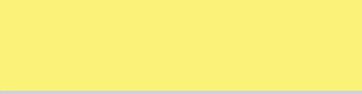
High quality

Compared with most conventional powder dyes, Macrolex® dyes are characterized by their consistent high quality.



PRODUCT RANGE

Macrolex® dyes in polystyrene + 2.0% TiO₂ (1/3 standard depth)

Dyes	Dyestuff type	Color Index Part I	Color Index Part II
 Macrolex® Yellow 6G Gran	Methine	Solvent Yellow 179; D. Y. 201	–
 Macrolex® Yellow 3G Gran	Pyrazolone	Solvent Yellow 93	48160
 Macrolex® Yellow G Gran	Quinophthalone	Solvent Yellow 114; D. Y. 54	47020
 Macrolex® Yellow E2R Gran	Quinophthalone	–	–
 Macrolex® Orange 3G Gran	Perinone	Solvent Orange 60	564100
 Macrolex® Orange R Gran	Methine	Solvent Orange 107; D. O. 47	–
 Macrolex® Red E2G Gran	Perinone	Solvent Red 179	564150
 Macrolex® Red A	Dyestuff mixture	–	–
 Macrolex® Red EG Gran	Perinone	Solvent Red 135	564120
 Macrolex® Red B	Azo	Solvent Red 195	–
 Macrolex® Red 5B Gran	Anthraquinone	Solvent Red 52	68210

Shades may differ from the real color due to printing influence.

Macrolex® dyes are available as granulates (Gran), fine gran (FG) or powder. Powder and FG are recommended for liquid masterbatches. For an individual product Gran and/or powder and/or FG may be available. In all tables only one product name extension is given (e.g. GRAN) while others (powder, FG) may also be available. SD (standard depth) refers to standardized coloration in opaque plastic using titanium dioxide. This allows comparison of dye efficiency for different colors. The SD concentration depends on the amount of titanium dioxide being used.

Dyes	Dyestuff type	Color Index Part I	Color Index Part II
 Macrolex® Red Violet R Gran	Anthraquinone	D. V. 31; D. V. 26; S. V. 59	62025
 Macrolex® Violet 3R Gran	Anthraquinone	Solvent Violet 36	–
 Macrolex® Violet B Gran	Anthraquinone	Solvent Violet 13	60725
 Macrolex® Blue 3R	Anthraquinone	–	–
 Macrolex® Blue RR Gran	Anthraquinone	Solvent Blue 97	615290
 Macrolex® Green 5B Gran	Anthraquinone	Solvent Green 3	61565
 Macrolex® Green G	Anthraquinone	Solvent Green 28	625580
 Macrolex® Black 2B	Dyestuff mixture	–	–
 Macrolex® Fluorescent Yel. 10GN	Coumarin	Solvent Yellow 160:1	–
 Macrolex® Fluorescent Red G	Coumarin	–	–
 Macrolex® Fluorescent Red 4B	Anthraquinone	Solvent Red 149	674700

Shades may differ from the real color due to printing influence.

S: solvent (e.g. S.V.59 is Solvent Violet 59)

D: disperse (e.g. D.V.26 is Disperse Violet 26)

Some dyes are listed as disperse and solvent dyes, different numbers are also given.

SUITABILITY

Dyes	Color Index Part I	PS	SB ¹⁾	ABS	SAN	PMMA	PC	PVC-U	PPO	PET	POM	PA 6/ PA 6.6	PBT	PES fibres
Macrolex® Yellow 6G Gran	Solvent Yellow 179; D.Y. 201	+	+	+	+	+	+	+	+	+	o	-	o	o
Macrolex® Yellow 3G Gran	Solvent Yellow 93	+	+	-	+	+	+	+	+	+	-	-	o	-
Macrolex® Yellow G Gran	Solvent Yellow 114; D.Y. 54	+	+	+	+	+	+	+	+	+	o	-	o	-
Macrolex® Yellow E2R Gran	-	+	+	+	+	+	+	+	+	+	o	-	o	+
Macrolex® Orange 3G Gran	Solvent Orange 60	+	+	+	+	+	+	+	+	+	o	+ ²⁾	o	-
Macrolex® Orange R Gran	Solvent Orange 107; D.O. 47	+	+	+	+	+	+	+	+	+	o	-	o	-
Macrolex® Red E2G Gran	Solvent Red 179	+	+	+	+	+	+	+	+	+	o	+	o	-
Macrolex® Red A	-	+	+	+	+	+	o	+	-	+	-	-	o	-
Macrolex® Red EG Gran	Solvent Red 135	+	+	+	+	+	+	+	+	+	o	+	o	+
Macrolex® Red B	Solvent Red 195	+	+	+	+	+	+	+	-	+	-	-	o	-
Macrolex® Red 5B Gran	Solvent Red 52	+	+	+	+	+	+	+	+	+	o	+	o	-
Macrolex® Red Violet R Gran	D.V. 31; D.V. 26; S.V. 59	+	+	+	+	-	o	+	+	o	o	-	o	+
Macrolex® Violet 3R Gran	Solvent Violet 36	+	+	+	+	+	+	+	+	+	o	+	o	-
Macrolex® Violet B Gran	Solvent Violet 13	+	+	+	+	+	+	+	+	+	o	-	o	-
Macrolex® Blue 3R	-	+	+	+	+	+	+	+	+	+	o	+	o	o
Macrolex® Blue RR Gran	Solvent Blue 97	+	+	+	+	+	+	+	+	+	o	+	o	o
Macrolex® Green 5B Gran	Solvent Green 3	+	+	+	+	+	+	+	+	+	o	+	o	o
Macrolex® Green G	Solvent Green 28	+	+	+	+	+	+	+	+	+	o	-	o	+
Macrolex® Black 2B	-	+	-	-	+	+	+	+	+	+	-	-	o	-
Macrolex® Fluorescent Yel. 10GN	Solvent Yellow 160:1	+	+	+	+	+	+	+	+	+	o	o	o	-
Macrolex® Fluorescent Red G	-	+	+	+	+	+	+	+	+	+	o	-	o	-
Macrolex® Fluorescent Red 4B	Solvent Red 149	+	+	+	+	+	+	+	+	+	o	+	o	-

¹⁾ not suitable for styrene-butadiene block copolymers

²⁾ limited usage in PA due to sublimation

+ suitable

o suitable with restrictions

- not recommended

HEAT STABILITY OF MACROLEX® DYES (°C) IN PLASTICS

according to DIN EN 12877-2

Dyes	PS	SB	ABS	SAN	PMMA	PC	PA 6	PA 6.6	PET	PBT
Macrolex® Yellow 6G Gran	300	300	260	280	300	350	–	–	300	280
Macrolex® Yellow 3G Gran	300	280	–	260	300	340	–	–	280	280
Macrolex® Yellow G Gran	300	300	300	300	300	340	–	–	300	280
Macrolex® Yellow E2R Gran	300	300	300	300	300	340	–	–	320	280
Macrolex® Orange 3G Gran	300	300	300	300	300	350	300	300	320	280
Macrolex® Orange R Gran	300	300	300	300	280	320	–	–	300	280
Macrolex® Red E2G Gran	300	300	300	300	300	350	300	300	320	280
Macrolex® Red A	300	280	280	300	280	300	–	–	300	–
Macrolex® Red EG Gran	300	300	280	300	300	350	260	260	320	280
Macrolex® Red B	280	280	280	280	280	300	–	–	280	300
Macrolex® Red 5B Gran	280	280	300	300	300	350	300	290	300	280
Macrolex® Red Violet R Gran	300	300	280	300	–	300	–	–	260	280
Macrolex® Violet 3R Gran	300	300	280	300	300	350	280	260	320	280
Macrolex® Violet B Gran	300	300	280	300	300	350	–	–	290	280
Macrolex® Blue 3R	300	300	300	300	300	340	280	270	300	280
Macrolex® Blue RR Gran	300	300	300	300	300	340	300	280	300	280
Macrolex® Green 5B Gran	300	300	300	300	300	350	280	260	310	280
Macrolex® Green G	300	300	300	300	300	350	–	–	300	280
Macrolex® Black 2B	300	–	–	280	300	340	–	–	300	300
Macrolex® Fluorescent Yel. 10GN	300	300	260	300	300	350	240	240	280	280
Macrolex® Fluorescent Red G	300	260	240	300	300	350	–	–	300	280
Macrolex® Fluorescent Red 4B	300	–	280	380	300	350	280	260	290	280

– not recommended

1/3 standard depth with 1 % TiO₂ (ABS 4 % TiO₂, PS 2 % TiO₂)

Plastics and TiO₂ used for testing:

PS: BASF Polystyrene 143E
 SB: BASF Polystyrene 472C
 ABS: Styrolution Novodur P2X
 SAN: BASF Luran® 368R
 PMMA: Evonik Plexiglas® 7H
 PC: Covestro Makrolon® 2800

PA 6: LANXESS Durethan® B30S
 PA 6.6: LANXESS Durethan® A30H 1.0
 PET: Voridian® 9921 W
 PBT: LANXESS Pocan® B1505
 TiO₂: Kronos 2233

The test results were evaluated under the above mentioned conditions and using the listed polymers. For other polymers, polymer grades, TiO₂ grades and dyes concentrations, the heat stability may be different from the values above.

LIGHT FASTNESS OF MACROLEX® DYES

according to DIN EN ISO 4892-2

	PC			PS			PMMA		
	1/3 SD Reduction 1.0 % TiO ₂		Transparent 0.05 % dye	1/3 SD Reduction 2.0 % TiO ₂		Transparent 0.05 % dye	1/3 SD Reduction 1.0 % TiO ₂		Transparent 0.05 % dye
	Dye content in %	Blue Wool Scale	Blue Wool Scale	Dye content in %	Blue Wool Scale	Blue Wool Scale	Dye content in %	Blue Wool Scale	Blue Wool Scale
Macrolex® Yellow 6G Gran	0.070 %	7	8	0.360 %	6-7	8	0.070 %	6-7	8
Macrolex® Yellow 3G Gran	0.142 %	7	8	0.260 %	6-7	8	0.142 %	6-7	8
Macrolex® Yellow G Gran	0.065 %	7	8	0.120 %	6-7	8	0.065 %	7	8
Macrolex® Yellow E2R Gran	0.070 %	7	8	0.140 %	6-7	8	0.070 %	7	8
Macrolex® Orange 3G Gran	0.155 %	7	8	0.280 %	6	8	0.155 %	6	8
Macrolex® Orange R Gran	0.045 %	5	8	0.090 %	4	7	0.045 %	3-4	7
Macrolex® Red E2G Gran	0.160 %	5	8	0.300 %	4-5	8	0.160 %	4	8
Macrolex® Red A	0.060 %	5	8	0.110 %	4	7	0.060 %	3-4	7
Macrolex® Red EG Gran	0.210 %	7	8	0.400 %	6	8	0.210 %	7	8
Macrolex® Red B	0.060 %	8	8	0.120 %	6	7-8	0.060 %	6-7	7-8
Macrolex® Red 5B Gran	0.100 %	4-5	7	0.195 %	3-4	7	0.100 %	4-5	7
Macrolex® Red Violet R Gran	0.105 %	6-7	7-8	0.200 %	6	7-8	–	–	–
Macrolex® Violet 3R Gran	0.125 %	6-7	7	0.220 %	6	7	0.125 %	6-7	7
Macrolex® Violet B Gran	0.090 %	6-7	7-8	0.180 %	5-6	7-8	0.090 %	6-7	7-8
Macrolex® Blue 3R	0.110 %	6	8	0.210 %	6	8	0.110 %	6	8
Macrolex® Blue RR Gran	0.125 %	6	8	0.230 %	6	8	0.125 %	6	8
Macrolex® Green 5B Gran	0.105 %	6	7-8	0.200 %	5-6	7-8	0.105 %	6	7-8
Macrolex® Green G	0.150 %	7-8	8	0.300 %	7	8	0.150 %	7	8
Macrolex® Black 2B	0.100 %	7-8	8	0.180 %	6	7-8	0.100 %	6	7
Macrolex® Fluorescent Yel. 10GN	0.100 %	5	6-7	0.200 %	3-4	6	0.100 %	4	6
Macrolex® Fluorescent Red G	0.100 %	5	7	0.200 %	4	7	0.100 %	3-4	7
Macrolex® Fluorescent Red 4B	0.100 %	2	3-4	0.180 %	1-2	2-3	0.100 %	2	7-8

– not recommended

Plastics and TiO₂ used for testing:

PC: Covestro Makrolon® 2800
 PS: BASF Polystyrene® 143E
 PMMA: Evonik Plexiglas® 7H
 TiO₂: Kronos 2233

The test results were evaluated under the above mentioned conditions and using the listed polymers. For other polymers, polymer grades, TiO₂ grades and dye concentrations, the light fastness may be different from the values above.
 The results were evaluated against the 8-step blue wool scale. Fastness at step 8 indicates very good light fastness and at to step 1 poor light fastness.
 The dye concentration to achieve a 1/3 SD (33% of standard density) coloration depends on the amount of TiO₂.
 Most SD in PC and PMMA are identical (1% TiO₂) while SD for PS is almost 2x higher due to the increased amount of TiO₂ (2%).
 Lower TiO₂ would allow a standard coloration with less dye.

SOLUBILITY OF MACROLEX® DYES

according to DIN EN ISO 7579

	Acetone	Benzyl alcohol	Butyl acetate	Ethanol	MMA	Methylene chloride	Styrene monomer	Xylene	MEK	Toluene	Paraffin 52/54	Stearic acid
Macrolex® Yellow 6G Gran	200	65	90	2	120	550	390	130	350	250	<1	15
Macrolex® Yellow 3G Gran	10	5	8	0.6	7	180	50	25	21	21	2	12
Macrolex® Yellow G Gran	0.5	2	0.5	0.1	1	6	3	1.5	*	*	*	*
Macrolex® Yellow E2R Gran	0.6	2.5	0.5	<0.1	1.5	10	3.5	1.6	*	*	*	*
Macrolex® Orange 3G Gran	1	4	1.5	0.2	3	10	7	5	*	*	*	*
Macrolex® Orange R Gran	3.5	65	3	0.8	1.5	60	5	1	*	*	1	5
Macrolex® Red E2G Gran	0.5	20	0.7	<0.1	1.5	7	4.5	2.5	2	3	*	*
Macrolex® Red A	0.4	1	0.4	0.1	1	45	4	1	*	*	*	*
Macrolex® Red EG Gran	<0.1	0.3	<0.1	<0.1	0.2	0.1	1	0.7	*	*	*	*
Macrolex® Red B	0.2	0.5	0.2	<0.1	0.5	40	3.5	0.5	*	*	*	*
Macrolex® Red 5B Gran	0.3	5	0.3	0.1	0.5	35	3	2	*	*	1	10
Macrolex® Red Violet R Gran	20	6	20	0.7	35	40	25	12	1	20	1	20
Macrolex® Violet 3R Gran	2	5.5	3	0.2	8.5	50	30	2.5	4	2	<1	10
Macrolex® Violet B Gran	1.5	4	3	0.1	5.5	30	12	8	2	7	<1	20
Macrolex® Blue 3R	20	100	60	1.5	90	250	100	150	*	*	*	*
Macrolex® Blue RR Gran	3	5	11	0.3	20	240	55	120	13	125	2	5
Macrolex® Green 5B Gran	1	3.5	3	0.1	4.5	20	12	17	2	20	1	10
Macrolex® Green G	2	4	4.5	<0.1	10	55	25	30	*	*	1	10
Macrolex® Black 2B	1.5	4.0	3.0	0.1	5.5	30	12	8	*	*	*	*
Macrolex® Fluorescent Yel. 10GN	2.5	12	1.5	0.4	2	70	4.5	1.5	*	*	*	*
Macrolex® Fluorescent Red G	0.3	0.5	0.2	<0.1	0.4	8	1	0.4	*	*	<1	1
Macrolex® Fluorescent Red 4B	0.1	*	*	0.1	*	*	*	1.4	*	*	*	*

– not soluble

* data not available

Solvent solubility is measured in g/l at room temperature (23°C/73°F)

These items are provided as general information only. They are approximate values and are not considered part of the product specifications.

MELTING AND SUBLIMATION TEMPERATURE OF MACROLEX® DYES

Product	Melt [°C]	Smp [°C]
Macrolex® Yellow 6G Gran	115	340
Macrolex® Yellow 3G Gran	187	310
Macrolex® Yellow G Gran	264	320
Macrolex® Yellow E2R Gran	212	380
Macrolex® Orange 3G Gran	230	270
Macrolex® Orange R Gran	224	320
Macrolex® Red E2G Gran	255	350
Macrolex® Red A	195	290
Macrolex® Red EG Gran	318	370
Macrolex® Red B	210	310
Macrolex® Red 5B Gran	280	375
Macrolex® Red Violet R Gran	186	330
Macrolex® Violet 3R Gran	213	350
Macrolex® Violet B Gran	189	315
Macrolex® Blue 3R	167	325
Macrolex® Blue RR Gran	200	350
Macrolex® Green 5B Gran	213	360
Macrolex® Green G	245	390
Macrolex® Black 2B	180	294
Macrolex® Fluorescent Yel. 10GN	209	340
Macrolex® Fluorescent Red G	254	320
Macrolex® Fluorescent Red 4B	268	336



Melt = melting temperature in °C

Sublimation temperature (Smp) has been determined by heating the dyes 10°C per minute starting at 20°C.

Temperature resulting in 5% loss of mass is given as Smp.

Low Smp may result in some sublimation during the injection molding process which could result in dye building up on the tools.

MACROLEX® DYES – ECOLOGICAL STATUS

Macrolex® dyes meet the high purity requirements of many application areas. These purity requirements are described below in detail.

Packaging:

- Directive 94/62/EC
- The overall concentration of lead, cadmium, mercury or hexavalent chromium must not exceed 100 ppm by weight (0.01 %).

RoHS:

- (Restriction of the use of certain hazardous substances in electrical and electronic equipment).
- Directive 2011/65/EU for Europe.
- Similar regulations exist in Japan, the United States and China.

Toys:

- EN 71-3 (Safety of toys: Migration of certain elements).
- EN 71-9 (Safety of toys: Requirements of organic chemical compounds). Because of the chemical classification, Macrolex Yellow 3G is not recommended.

Food contact

Many national regulations for example:

- **Europe:** Resolution AP (89) 1. The purity requirements are met by all Macrolex® dyes. Because of the chemical classification, Macrolex® Yellow 3G and Macrolex® Black 2B are not recommended.
- **United States:** Nearly all Macrolex® dyes are approved for the coloring of PET in accordance with the FDA regulations, at loadings less than 0.20 %.
- **Japan:** JHOSPA (Japan Hygienic Olefin and Styrene Plastics Association).

The prerequisite for the use of colorants in food contact applications is a maximum of 100 ppm lead, 50 ppm mercury and 100 ppm cadmium.

- **Australia-Standard 2070.6:** Plastic Materials for Food Contact Use: Limiting values for heavy metals. primary aromatic amines.
- **China:** GB9685 Hygienic Standards for Uses of Additives in Food Containers and Packaging Materials.

LANXESS Macrolex® grades fulfill these requirements and many other national regulations. Due to their high purity, they offer significant advantages to the end user.

REACH: Registration, Evaluation and Authorization of Chemicals. LANXESS submitted all necessary pre-registration information to the European Chemicals Agency (ECHA).

All products are registered.

For more information please contact your local LANXESS representative, visit our website www.lanxess.com or send an email to colorant.additives@lanxess.com.



■ PET-Bottles colored with Macrolex®

STATUS OF MACROLEX® IN EUROPE, AMERICA AND CHINA

	Europe			USA				China
	AP (89)1	BFR	FPL	PS, EPS	Tritan	PET	max %	PET
Macrolex® Yellow 6G Gran	Yes	Yes	Yes		<100 °C	C-G	0.4 %	Yes
Macrolex® Yellow G Gran	Yes	Yes	Yes			C-G	0.2 %	Yes
Macrolex® Yellow E2R Gran	Yes	Yes				C-G	0.2 %	Yes
Macrolex® Orange 3G Gran	Yes	Yes	Yes			C-G	0.2 %	Yes
Macrolex® Orange R Gran	Yes	Yes	Yes	D-G	<100 °C	C-G	0.2 %	Yes
Macrolex® Red E2G Gran	Yes	Yes			<100 °C	C-G	0.2 %	Yes
Macrolex® Red A	Yes	Yes				C-G	0.1 %	
Macrolex® Red EG Gran	Yes	Yes	Yes	D-G		A-H	0.6 %	Yes
Macrolex® Red B	Yes	Yes				C-G	0.4 %	
Macrolex® Red 5B Gran	Yes	Yes	Yes			C-G	0.2 %	
Macrolex® Red Violet R Gran	Yes	Yes	Yes	D-G	<100 °C	C-G	0.6 %	Yes
Macrolex® Violet 3R Gran	Yes	Yes	Yes			C-G	0.2 %	Yes
Macrolex® Violet B Gran	Yes	Yes	Yes		<100 °C	D-G	0.2 %	Yes
Macrolex® Blue 3R	Yes	Yes		D-G	<100 °C	A-H	0.6 %	Yes
Macrolex® Blue RR Gran	Yes	Yes	Yes		<100 °C	C-G	0.2 %	Yes
Macrolex® Green 5B Gran	Yes	Yes	Yes	D-G	<100 °C	C-G	0.6 %	Yes

Germany: BfR, AP(89)1: use of colorants in plastic materials coming into contact with food.

EN71-3: Safety of toys EN71/3 (all Yes: Macrolex® good according to regulation).

Europe: Directive 94/62/EC and CONEG: sum of lead, cadmium, hexavalent chromium and mercury is lower than 100 ppm (all Yes).

RoHS: Restriction on the use of certain hazardous substances in electrical and electronic equipment (all Yes).

FPL: French Circular 176 (positive list).

USA FDA: Contact with aqueous, acid, low alcohol content (up to 15% ethanol) and dry foods, conditions under 21 CFR §176.170; available are opinion letters from Keller and Heckman; PS, EPS data met for 0.2% concentration.

Tritan (Eastman) <100 °C: repeat-use articles at temperatures of 100 °C and below.

PET maximum level of concentration is met.

CHINA: GB9685; mostly given for concentration of 0.2%; other polymers like PS, ABS, PC, PA also met.

More details of regulations concerning Macrolex® can be provided on request.

JHOSPA LISTING FOR MACROLEX® IN JAPAN



Macrolex®	ABS	AS	PS	PC	PMMA	PET	PBT	PA	PPE
Macrolex® Yellow 6G Gran	++	++	+	++	ACD	++			
Macrolex® Yellow 3G Gran	CD	++	+	ABD	ACD	ACD	A		
Macrolex® Yellow G Gran	CD	++	+	++	CD	ACD			
Macrolex® Yellow E2R Gran	++	++	+	++	++	++	++		
Macrolex® Orange 3G Gran	+	++	+	ABD	ACD	++	C		
Macrolex® Orange R Gran	++	++	+	++	ACD	A	ACD		
Macrolex® Red E2G Gran	+	++	+	++	+	++		CD	
Macrolex® Red EG Gran	++	++	+	++	+	++	+		+
Macrolex® Red B	+	CD	BD	++		++	+		
Macrolex® Red 5B Gran	++	++	+	++	++	++	ACD	ACD	CD
Macrolex® Red Violet R Gran	++	++	+	++	++	++	ACD		+
Macrolex® Violet 3R Gran	+	++	+	++	++	++	++	CD	+
Macrolex® Violet B Gran	+	++	+	++	++	++	++		+
Macrolex® Blue 3R	+	++	+	++	++	++			
Macrolex® Blue RR Gran	++	++	++	++	++	++	++		+
Macrolex® Green 5B Gran	++	++	+	++	++	++	++		CD
Macrolex® Green G	++	++	+	++	++	++			

AS (acrylonitrile-styrene) is a different term for SAN (Styreneacrylonitrile)

Applications

- A: Oil and fat, fatty foods
- B: Alcoholic foods
- C: Neutral foods (pH>5)
- D: Acid foods (pH<5)

Marks in sheet

- ++ approved for ABCD
- +
- ACD approved for ACD

Self-restrictive requirements on food-contacting articles made of polyolefins and certain polymers. The JHOSPA list shows powder, FG and Gran. Only one value is given below. Approval of Macrolex® dyes depends on the polymer and field of application.

BAYPLAST® PIGMENTS

In addition to our range of **Macrolex®** solvent dyes, LANXESS offers **Bayplast®** organic pigments: **Bayplast® Yellow G Gran** and **Bayplast® Yellow 5GN**. These brilliant pigments show excellent heat stability, light fastness and weatherability and are suitable for the coloration of most engineering thermoplastics including PA 6 and PA 6.6, polyolefins and PVC.

In contrast to **Macrolex®** dyes these pigments are also suitable for polyolefins like polypropylene.

Bayplast® Yellow G Gran is formulated in a unique microgranular form, which offers the following advantages:

- Lower dust formation
- Easier to process than conventional powders
- Excellent handling and flow properties
- More precise metering
- Improved dispersion characteristics
- Higher bulk density
- Less residue remains when package is emptied



Heat stability of Bayplast® pigments in polypropylene (transparent / 1% TiO₂ 1/3 standard depth)

Pigments		HD-PE	PP	PS	ABS	PBT	PET	PA 6	PA 6.6
	Full shade	300	300	300	280	270	280	260	–
	Reduction with white	300	300	300	280	270	280	260	–
Bayplast® Yellow G Gran									
	Full shade	300	300	300	280	270	300	280	270
	Reduction with white	300	300	300	280	270	300	280	270
Bayplast® Yellow 5GN01									

Light fastness of Bayplast® pigments

Pigments		HD-PE	PP	PS	ABS	PBT	PET	PA 6	PA 6.6
	Full shade	8	8	8	8	7	8	8	–
	Reduction with white	8	8	8	8	7	8	6-7	–
Bayplast® Yellow G Gran									
	Full shade	8	8	8	6-7	8	8	8	8
	Reduction with white	8	8	8	8	8	8	8	8
Bayplast® Yellow 5GN01									

Shades may differ from the real color due to printing influence.

Materials¹⁾ and concentrations²⁾ used for testing of heat stability and light fastness:

1) HD-PE: SABIC Sabic® M8003
 ABS: DOW Magnum 3453
 PA 6: LANXESS Durethan® B30S

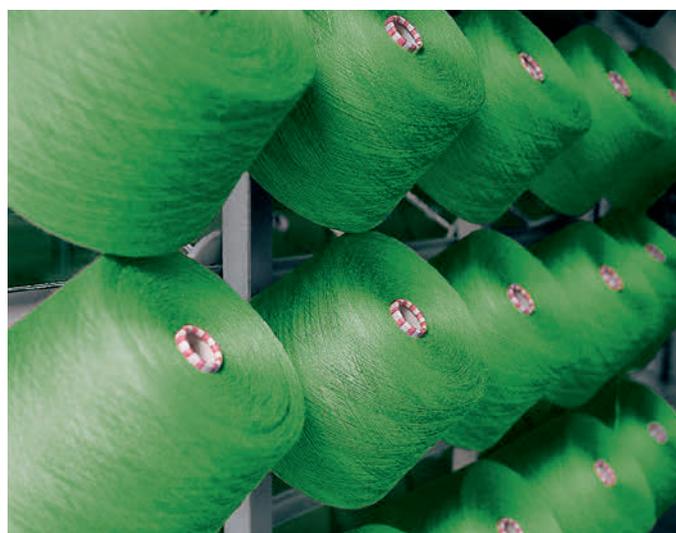
PP: PIO Kunststoffe Stamylan® P
 PBT: LANXESS Pocan® B1505
 PA 6.6: LANXESS Durethan® A30H 1.0

PS: BASF Polystyrene 143E
 PET: VORIDIAN Voridian® 9921 W
 TiO₂: Kronos 2233

²⁾ 0.1% pigment + 1% TiO₂

– not recommended

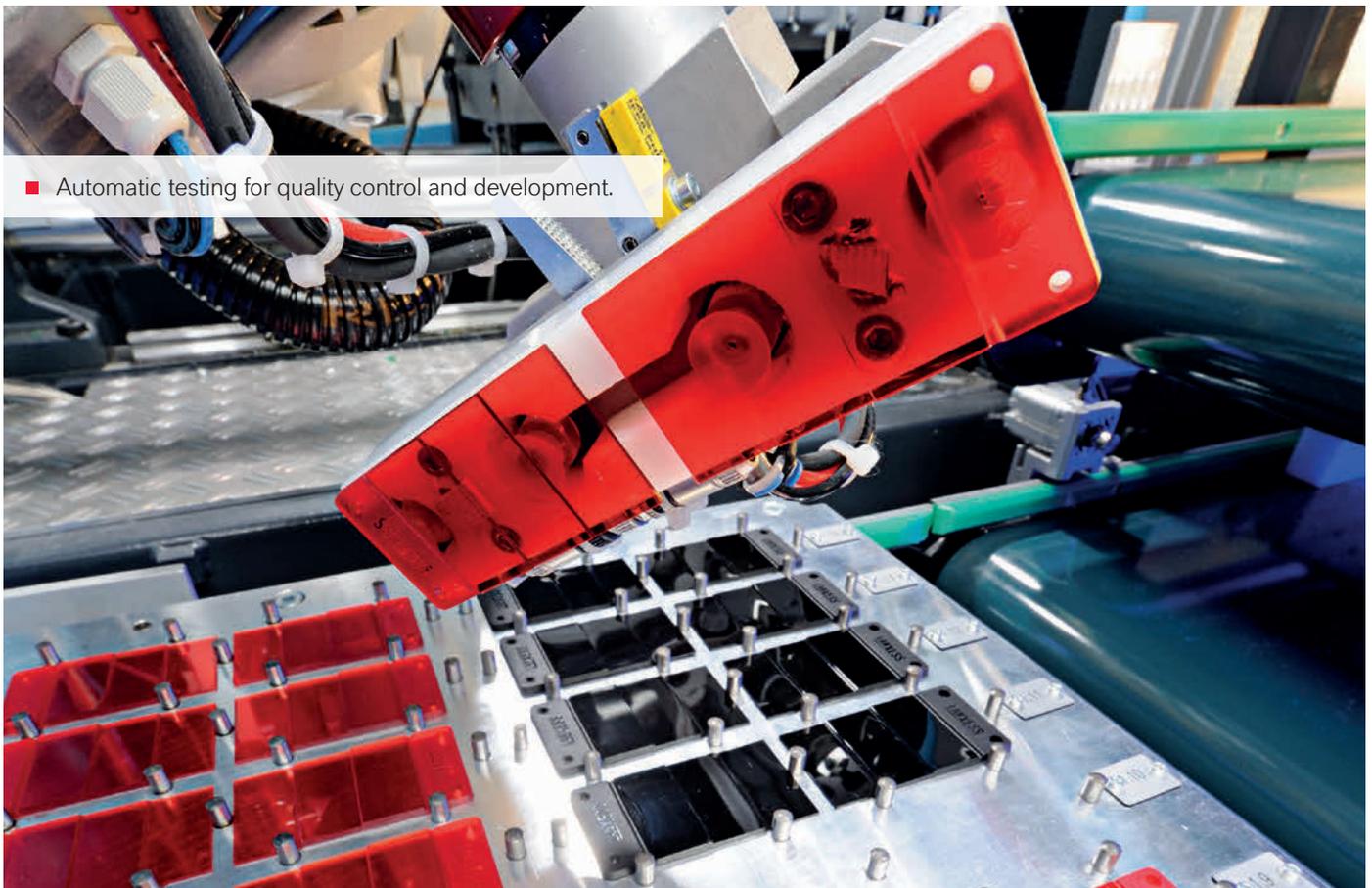
The test results were evaluated under the above mentioned conditions and using the listed materials. For other polymers, polymer grades, TiO₂ grades and pigment concentrations, the results may be different from the values above.



TECHNICAL SERVICE CENTER

As a diversified supplier of high-quality colorants it is our goal to provide our customers with solutions for all color-related questions at a global and regional level. Our laboratories can assist with technical support. In this regard our technical service units are able to support our customers with a wide range of different test methods, such as color matching, light fastness and weather resistance as well as heat stability tests. A fully equipped plastics laboratory allows for customer-oriented development solutions and can be used for all technical service issues. Powerful analytical laboratories for chemical and physical test methods such as particle size determination, specific surface, trace analytics for metal ions or organic contamination complement our service portfolio.

Test results for all our dyes and pigments in all relevant amorphous and semi-crystalline thermoplastics have been categorized and are available in both full color and white blend. Based on this we are in a position to provide color matching services based on customer requests at short notice. Details with regard to application area, fastness requirements or used additives can help us achieve the precise match. For optimal results the provision of the customer compound is ideal. Furthermore, we can provide additional services in connection with light fastness, weather resistance and heat stability in customer systems.



■ Automatic testing for quality control and development.





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