



Additives Guide
SINGLE METAL AND MIX DRIERS

DRIERS

The chemical hardening of unsaturated liquid binders (cooked oils, alkyd, epoxy-ester etc. oligomeric resins, which molecules contain activated double bonds in sufficient concentration) by means of the reaction with atmospheric oxygen is described as drying

Such reactions between unsaturated resins and atmosphere oxygen proceed according to the mechanism of oxidative polymerization and lead to the formation of three-dimensional cross-linked polymer structures and, therefore, solid and hard films.



DRYING MECHANISM

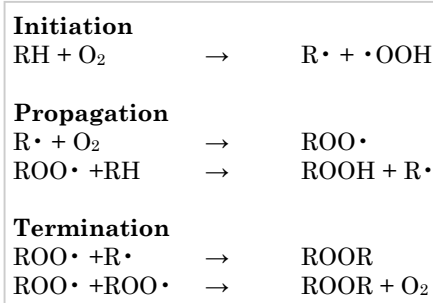
The drying mechanism can be subdivided into 4 stages:

- Induction period
- Peroxide formation
- Peroxide decomposition into free radicals
- Free radical polymerization (cross-linking)

Once the film is applied and the solvent evaporates, the induction step is over and the oxygen uptake starts causing peroxide formation.

Once the peroxide is formed, the peroxide decomposition occurs resulting in the formation of reactive free radicals.

The formed free radicals are very reactive species which start a cascade of polymerization reactions enabling a progressive increase in molecular weight and finally formation of a hard film.



DEFINITIONS

Metal-organic compounds (metal soaps or complex) are used in relatively small concentrations to control (i.e. to initiate and accelerate) drying processes. Such additives are described as driers (also referred to as siccatives when in solution).

Driers are also used in peroxide-initiated drying of compositions based on unsaturated polyester resins.

From the chemical standpoint, driers are molecular (homophase) catalysts for free radical oxidative polymerisation, which is a chain process developing in the presence of the atmosphere oxygen.

Metal ions are active ingredients of driers, and organic portion of their molecules determines largely whether the drier will meet its basic requirements which are:

- Good solubility and high stability in various kinds of binders
- Good storage stability of the drier
- Ability to be present in a high metal concentration
- Sufficiently low viscosity, to make the handling of the drier easier
- Optimal catalytic effect of the drier
- Best price/performance relation

According to their application in various binders, the driers can be classified as used in either in solvent- or water-based compositions, and intended for either ambient dry condition (temperature interval 5-30 °C) or for bake systems (above 80 °C).

DRIERS

Right choice of drier (or a combination of driers) allows:

- Fast and uniform drying of moderately thick films (normally up to 60 microns)
- Minimization of the double bonds present in resin molecules, that results in less after-cure (which causes the film to become brittle) and longer service life for the coating

Driers for solvent-based coatings are mainly salts of mono-carboxylic acids (octoates, decanates, synthetic fatty acids C₆-C₁₈) and naphthenic acids.

According to metal and drying mechanism (function), the following drier groups are different:

- Primary driers (active driers), containing mainly Co, Mn, Fe or V ions existing in various (multiple) oxidation states and which high valence state is less stable than the lower one
- Secondary driers (auxiliary driers), based on salts of Ca, Zn, Pb, Zr, Li, Ba, K ions, which exist in one oxidative state and active when combined with primary driers

None of the single metal soap can perform successfully enough to provide sufficiently fast and, at the same time, top-to-bottom uniform dry films (dry through). Therefore, commercially available two forms of driers:

- Single-metal driers, which paint formulators use to combine in each binder to reach required dry fastness and coating performance
- Combined (formulated) driers commonly called mix-driers, which contain optimal combinations of individual siccatives

In solvent-based air-drying systems, the same cobalt-based drier will be able to function satisfactorily in many different coating types. This is not the case in waterborne or water-reducible systems as the drier system is strongly dependent on the nature of each individual coating product. This is partly due to the large diversity of water-reducible binders and partly due to the presence of certain ingredients in some waterborne systems that may affect the driers.

The different compositions of water-soluble and solvent soluble oxidatively drying coating materials make accurate adjustments to the drier system essential.

The traditional driers, used in solvent-based paints are dissolved in mineral spirits or xylene and are not easily dissolved or emulsified in water.

These classical driers can be used in waterborne systems by mixing the drier with the binder system, prior to the neutralization stage of the resin.

However, the drier may destabilize the emulsion of the binder, leading to a change in viscosity and stability of the paint.

One can improve the compatibility of the driers with such binders by adding suitable surfactants and polar solvents to the drier. Furthermore, the effectiveness of the drier depends on the stage at which it is added during the manufacturing of the coating material.

Best results are normally obtained when the drier is added during the let-down stage of the coating manufacturing process. In this case, only water-emulsifiable driers can be used.



DRIERS

The presence of large volumes of water changes the drying chemistry of air drying binders. Water acts as a chain transfer agent in the free radical mechanism, which can slow the rate of the desired free radical reactions markedly. Therefore, large amounts of driers are needed in the waterborne systems.

PRODUCT OFFERING

DELTA specialties offers a broad range of driers to help you control the drying time of your coating films.

For solvent-based systems, we offer:

- Single metal driers

MORDRY® Barium 12.5
MORDRY® Calcium 4
MORDRY® Calcium 10
MORDRY® Cobalt 6
MORDRY® Cobalt 10
MORDRY® Lead 24
MORDRY® Lead 32
MORDRY® Lead 36
MORDRY® Lithium 2
MORDRY® Manganese 10
MORDRY® Potassium 10
MORDRY® Zinc 16
MORDRY® Zirconium 12
MORDRY® Zirconium 18

- Mix-driers

MORDRY® 210
MORDRY® 320
MORDRY® 345
MORDRY® 380
MORDRY® 390

- Driers in special carrier

MORDRY® Cobalt 6P
MORDRY® Cobalt 6T

For water-reducible systems, we offer:

MORDRY® Barium 10 WD
MORDRY® Calcium 4 WD
MORDRY® Cobalt 6 WD
MORDRY® Manganese 6 WD
MORDRY® Zirconium 12 WD

**Some think business opportunities,
we think business partnerships**

DELTA specialties

Al-Moustafa For Industries & Designs

Swiss Compound
4th Industrial Zone
6th of October City
A. Republic of Egypt

Tel.: +202 330 381 15
Fax: +202 330 311 81
E-mail: info@deltaspwll.com
Web: www.deltaspwll.com