

## Effective Catalyst for Esterification and Transesterification Reactions

Dorf Ketal is the industry pioneer and a global leader in producing and supplying organic titanates and zirconates. For more than 50 years, Dorf Ketal has been delivering innovative, high-quality Tyzor® compounds to meet the evolving needs of a wide range of industrial markets. Dorf Ketal offers more than 40 grades of Tyzor®, including several specialty compounds.

### Diverse Applications

Dorf Ketal Tyzor® organic titanates and zirconates are excellent catalysts for esterification and transesterification reactions. They can act as Lewis acid catalysts and allow for optimization of product properties and processes.

Some of the typical reactions for which Tyzor® organic titanates and zirconates act as an efficient catalyst include:

- Acrylate esters
- Plasticizers (e.g., phthalate esters)
- Polyesters (e.g., PET, PBT)
- Unsaturated polyester resins

### Transesterification

Highly reactive alkoxides such as Tyzor® TPT, Tyzor® TnBT, and Tyzor® TPT-20B are very efficient transesterification catalysts. As long as water is excluded, they react quickly with little byproduct formation.

Higher molecular weight alkoxides such as Tyzor® TOT, as well as chelates, such as Tyzor® TE, are more stable to the presence of water and other Lewis bases. They provide enhanced compatibility with some systems, but may require higher temperature and longer reaction time.

Some specialty grades are also available which offer even greater water stability, plus lower color generation in many systems which are particularly sensitive to discoloration.

### Esterification

The same Dorf Ketal Tyzor® organic titanates and zirconates which catalyze transesterification also function as esterification catalysts. Because water is generated during direct esterification reactions, the water-sensitivity of the reactive alkoxides may require higher catalyst loading or continuous removal of the water being generated. In some cases the catalyst may be degraded, even to the point of formation of insoluble hydrated TiO<sub>2</sub> or ZrO<sub>2</sub>.

In these cases, the more water-stable titanates may be preferred despite the higher reaction temperature required. Tyzor® TOT, Tyzor® TE, and other specialty grades are all excellent alternatives for direct esterification.



# Dorf Ketal Tyzor®

## ORGANIC TITANATES AND ZIRCONATES

### Multitude of Benefits

As a Lewis acid catalyst, Tyzor® organic titanates and zirconates offer many advantages, including:

- High yield
- Easy optimization due to selection of correct grade
- Low catalyst loading
- Good product color and low odor
- Limited degradation to olefins
- High solubility in numerous solvents and reaction media
- Low toxicity, a distinct advantage over tin, antimony and mercury compounds
- Easy processing and removal

### Broad Product Selection

Tyzor® organic titanates and zirconates are available as reactive alkoxides or stable chelates of titanium or zirconium. When used for catalysis, the alkoxides are usually preferred. These alkoxides are moisture sensitive; therefore, they are typically added as the last ingredient. In general, titanates are more reactive than zirconates.

### Put Tyzor® to Work for You

The broad range of Tyzor® organic titanates and zirconates allows you to select the optimum grade to meet your specific needs, enabling you to produce superior quality products for a wide variety of applications and market segments.

And, with warehouses in every region and an integrated global network of highly trained sales and technical service professionals available to assist you, it is easy and convenient to put Tyzor® to work in your application anywhere in the world.