



POLYGEL

We Deliver Value

An ISO 9001 : 2008 Company

PUREtiTM

Organic Titanates



Polygel Industries Private Limited, a diversified conglomerate, made a humble beginning in 1996 as a result of shortage of Cable Gels in India. Responding to the market need, the company emerged as a market leader in India and Asia in a short span of 5 years.

Polygel today, offers over 40 specialty and performance chemicals, including a wide range of Organic Titanates, Zirconates, Phosphates and Tin Compounds (Organometallic Chemicals), for vital applications such as chemical processing for polymer industries, inks, paints and coating industries, polymer compounding, glass coatings, emission control, oleochemicals, oil fracing, Adhesives and Sealants, Construction Chemicals, Textures and Coatings for infrastructure and buildings, automotive and engineering, furniture and joinery, footwear, foam and furnishing industries.

Polygel's "**PUREti**" Organic Titanates, with their unique process and formulae, mark a visible and technical difference to the property of printing inks, paints and coatings, and hence are used to improve crosslinking and adhesion with the substrates, as well as to improve cure rates, improve speed and efficacy of reaction, improve scratch resistance, and remove moisture from the system.

Polygel's "**Turbofix**" range of Adhesives and "**Scottguard**" range of Construction Chemicals are distributed all across India to Institutional as well as Retail consumers for diverse applications ranging from Building Construction to Foam and Furnishing and are well respected in the market.

Polygel Industries has shown a remarkable growth with the support of 175 of highly skilled professionals operating from 6 Offices and 3 Manufacturing Locations spread across India. Exporting to more than 40 countries worldwide, including the USA, Germany, Japan, France, U.K., S. Korea, China, our presence is noted worldwide. Our International Investors and partners provide access to technology from all over the world which has helped us step up the quality of our product.

Quality has always been a driving factor for the company. Polygel is an ISO 9001:2008 company. Our R&D team relentlessly work towards improving performance, yield and efficiency of our customers products, using state-of-the-art testing & analytical equipment and manufacturing processes to offer optimum solutions for our customers, as well as customer's customer.



Organic Titanates & Zirconates

PUREti [™]	Chemical Name	CAS No.
PUREti TNBT / PS10	Tetra n-Butyl Titanate	5593-70-4
PUREti TIPT / TPT	Tetra Isopropyl Titanate	546-68-9
PUREti TEHT	Tetra 2-Ethylhexyl Titanate	1070-10-6
PUREti PBT	Poly Butyl Titanate	162303-51-7
PUREti BIPT / TPT15B	Isopropyl Butyl Titanate	68955-22-6
PUREti TNPT	Tetra n-Propyl Titanate	3087-37-4
PUREti TET	Tetra Ethyl Titanate	3087-36-3
PUREti PS8	Tetra t-Butyl Titanate	3087-39-6
PUREti NPZ	Tetra n-Propyl Zirconate	23519-77-9
PUREti NBZ	Tetra n-Butyl Zirconate	1071-76-7

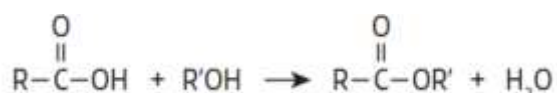
Titanium Chelates

PUREti TAA 65	Titanium Acetylacetonate	17927-72-9
PUREti TAA 75		
PUREti TGBA		
PUREti TAA 105	Titanium Acetylacetonate Complex	NA
PUREti TIC 30	Butyl Titanium Phosphate	109037-78-7
PUREti TEAT	Triethanolamine Titanate	36673-16-2
PUREti PS2	Di-iso-propoxy titanium bis ethyl acetoacetate	27858-32-8
PUREti PS4	Formulated PUREti PS2 and MTMS	27858-32-8
PUREti PS6 / PS6 L	Di-iso-butoxy titanium bis ethyl acetoacetate	83877-91-2
PUREti TX 100	Alkonolamine Titanate Complex	68784-47-4
PUREti TX 200	Alkonolamine Titanate Complex	68784-48-5
PUREti TX 300	Alkonolamine Titanate Complex	NA
PUREti TX 400	Alkonolamine Titanate Complex	1072830-14-8
PUREti AL	Titanium Ammonium Lactate	65104-06-5
PUREti PN	Ammonium Zirconium Lactate Acetate	68909-34-2
PUREti ZEA	Triethanolamine Zirconate	101033-44-7

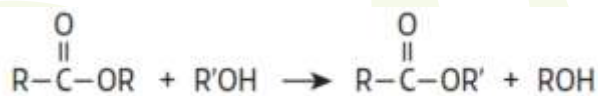
Esters and Esterification

PURE*ti* titanates are understood as Lewis acids suitable for esterification, trans-esterification and polyesterification catalyst usage.

Direct esterification is the reaction between a carboxylic acid and an alcohol to produce an ester plus water as showing below equation. With PURE*ti* titanates, esterification is conducted at 220 °C efficiently and catalyst is easily removed by water washing out.



In a trans-esterification reaction, a preformed ester exchanges alkoxy group with another alcohol to produce a new ester as below.



Polyesterification is an extension of either or both of the above reactions. Polyesters are produced by the interaction of a dibasic acid or its lower alkyl ester with a glycol or polyol, i.e. by direct or transesterification reactions.

Advantages of PURE*ti* Titanates

PURE*ti* titanates are neutral compounds and it is this neutrality that gives titanates many of their advantages over acidic and basic catalysts. Acids and bases cause side reactions and degradation of the reactants. This leads to poor color and contamination of both the product ester and any excess reactant. PURE*ti* titanates minimize these side reactions. It is therefore possible to use larger excesses of reactant alcohols, which can be recycled without intermediate purification. This in turn leads to higher conversions and yields of purer products. Effluent treatment is minimized or eliminated.

Other metallo-organic catalysts are available, for example, certain derivatives of tin, magnesium and aluminum. However, it is usually found that these are either more prone than titanates to cause side reactions or are less cost-effective.

Physical Properties

Product	Appearance	Ti Content %	Density g/ml	Boiling Point °C/mmHg	Flash Point °C	Melting/ Pour Point °C
PURE <i>ti</i> TIPT	Colorless or pale yellow liquid	16.8	0.96	230/760	41	Approx. 17.5
PURE <i>ti</i> TNBT	Pale yellow liquid	14.0	0.995	312/760	47	-40
PURE <i>ti</i> BIPT	Pale yellow liquid	16.3	0.98	236/70	42	-39
PURE <i>ti</i> TEHT	Yellowish liquid	8.5	0.935	205/1	>63	-49
PURE <i>ti</i> TET	Yellowish liquid	20.1	1.085	N/A	30	-40
PURE <i>ti</i> TNPT	Yellowish liquid	16.9	1.030	170/760	49	-50

Application Field

PURE*ti* titanates are the most successful brand in plasticizer industries, but not limited to these. The ranges are also widely used in fatty ester, polyester polyol, polyester including PET and PBT, and polyolefin industries around the world.

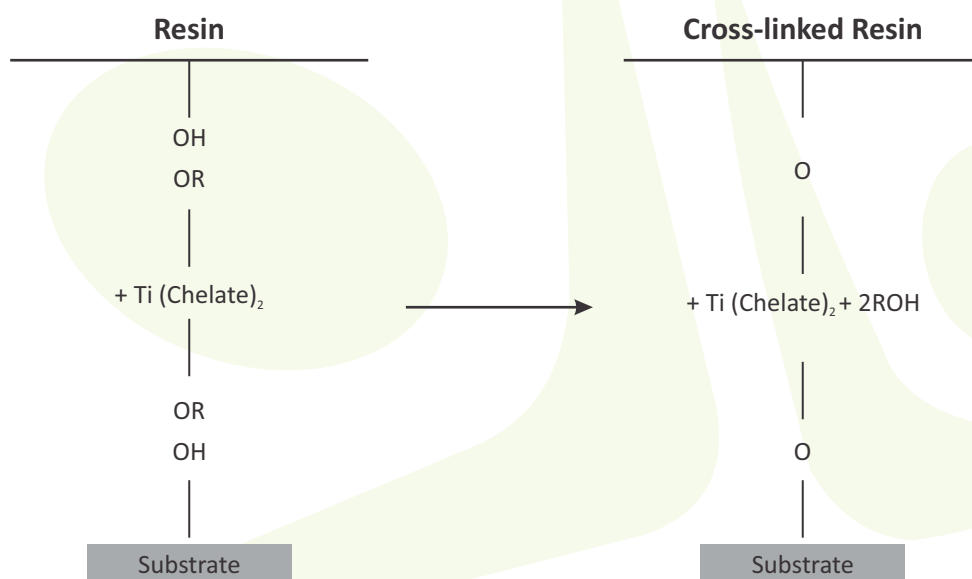


Inks for Flexible Packaging

The power of graphical messages is more than people could think of when people standing in front of the shelves in the supermarkets or convenient stores. The packaged foods and PET bottle soft drinks are within reaching distance in everyone's daily life.

What people do not know is that PURE*ti* titanates help the colorful printing inks attached firmly on the plain OPP films. Think about what if no titanates, normally NC/PU or NC/PA inks will easily fall out from the substrates, not even to say the frozen food or cold drinks in the fridge which sustained at low temperature.

Look into the mechanism, alcohol will be evaporated during the heating process, PURE*ti* titanium chelate will help linkage to substrate and resin.



Advantages of PURE*ti* Titanates

NC/PU or NC/PA film forming resins normally provide acceptable film strength after solvent evaporated. PURE*ti* titanates will upgrade the solvent resistance or heat resistance to next level, therefore, graphical print can last during long term frozen environment. The substrate has to be corona treated till 38 dyne or above readily for printing.

PURE*ti* TIC30 is a titanium phosphate ester complex listed on Swiss Ordinance for non-food contact printing inks. The unique performance combining titanate and phosphate ester properties brings the flexible printing industries more possibilities to promote their products. Though most of the people do not really know, PURE*ti* TIC30 is so reachable around.



Physical Properties

Product	Appearance	Chemistry	Ti Content %	Density g/ml	Flash Point °C	Pour Point °C
PUREti TIC30	Pale yellow liquid	Butyl Titanium Phosphate	8.7	1.00	12	-50
PUREti TAA65	Orange red liquid	Titanium Acetylacetonate	8.6	0.97	12	-70
PUREti TAA75	Reddish liquid		9.6	1.00	12	-20
PUREti TGBA	Dark red liquid		10.0	1.01	12	-42

Application Field

PUREti TIC30 is the most successful item in printing ink industries, but not limited to this. PUREti TAA65 and PUREti TAA75 are widely used in non food packaging field of applications, such as money inks.



RTV Silicone Sealant

Applications for silicone sealants are extremely broad. Markets include construction, automotive, assembly, maintenance, electrical/electronic, aerospace, and consumer products. Silicone sealants often compete with other materials such as polyurethanes, polysulfides, and acrylics. One of the most popular subclasses of silicone sealants is the RTV (room temperature vulcanizing) product. RTV silicone products are formulated from relatively low molecular weight linear polymers. A crosslinking

reaction begins at the time the product is exposed to air. These crosslinking reactions occur at room temperature, hence the term "RTV", and they are generally moisture-curing reactions. Among three types of RTV sealants classified by the curing mechanisms, PURE*ti* titanates crucially catalyze alkoxy type crosslinking reactions.

Moisture scavenging property contributed by PURE*ti* titanates is an additional benefit extending shelf life of the sealant cartridges.

Though the alkoxy type RTV sealant being invented 30 years ago, the formulation is not changed too much even today. PURE*ti* titanates continuously provide the highest liability to the harshest application field, such as glass wall architectures.

Advantages of PURE*ti* Titanates

PURE*ti* titanates provide superior catalysis performance, ie. quick tack free time, as well as adhesion promotion and crosslinking properties. Though condensation catalysts such as tin compounds can do the same, PURE*ti* titanates offer the non-toxic and reliable features than others.

Physical Properties

Product	Appearance	Chemistry	Ti Content %	Density g/ml	Flash Point °C	Melt/Pour Point °C
PURE <i>ti</i> TPT	Colorless liquid	Titanium isopropanolate	16.8	0.96	41	Approx. 17.5
PURE <i>ti</i> PS2	Orange red semi-solid	Titanium chelate	11.3	1.09	30	28
PURE <i>ti</i> PS4	Orange red liquid	Titanium chelate	9.2	1.08	36	<10
PURE <i>ti</i> PS6L	Orange red liquid	Titanium chelate	10.5	1.08	40	-20
PURE <i>ti</i> PS8	Pale yellow liquid	Titanium t-butanolate	14.0	0.90	42	<0
PURE <i>ti</i> PS10	Pale yellow liquid	Titanium n-butanolate	14.1	0.995	40	-70

Application Field

PURE*ti* PS ranges are readily applicable for RTV sealant formulators fitting into the consumer or industry usage. Furthermore, PURE*ti* primaries, such as TPT, PS8 or PS10 offer high purity, superior reliability and extraordinary stability for high end usage.



Wire Enamel Crosslinking

PURE*ti* TNBT is the most widely used crosslinking agent for wire enamel applications in the world. This traditional technology still plays an essential role for consumer electronic industries as long as motors keep serving. New technology may be introduced to this industry and PURE*ti* titanates will still offer unique performance for new challenges.



Anti-corrosive Coatings Crosslinking



Not too many formulators can properly use PURE*ti* titanates for coating applications, however, the superior passivation performance by using PURE*ti* titanates torches the pathway to industries getting rid of toxic corrosion inhibitors, such as Cr(VI) or Cr(III) compounds completely. The baking process applied for fastener coatings will create the hybrid titanium rich micro-segregations evenly spread on the coating surface, and the Ti-O bonding strength is far stronger than any organic bond, which makes 1,000 hours SST (salt spray test) possible.

Not only for well-known zinc rich primer or sealer coatings, industrial applicators successfully apply PURE*ti* titanates on coils for temporary protection. The water based thin coating layer provides steel manufacturers conducting long haul shipment without worry about corrosion on the way.

Fracking Fluids Crosslinking

Booming shale gas development changes the energy market. Following up the latest hydraulic fracturing technology, PURE*ti* zirconates play the key role for fracking fluids sustaining the deep drilling temperature underground. Among the applicable chemicals for drilling purpose, PURE*ti* zirconates are proven to be environmental friendly ones with superior performance.

PURE*ti* titanates share the same importance of the application as PURE*ti* zirconates in off-shore drilling technology.



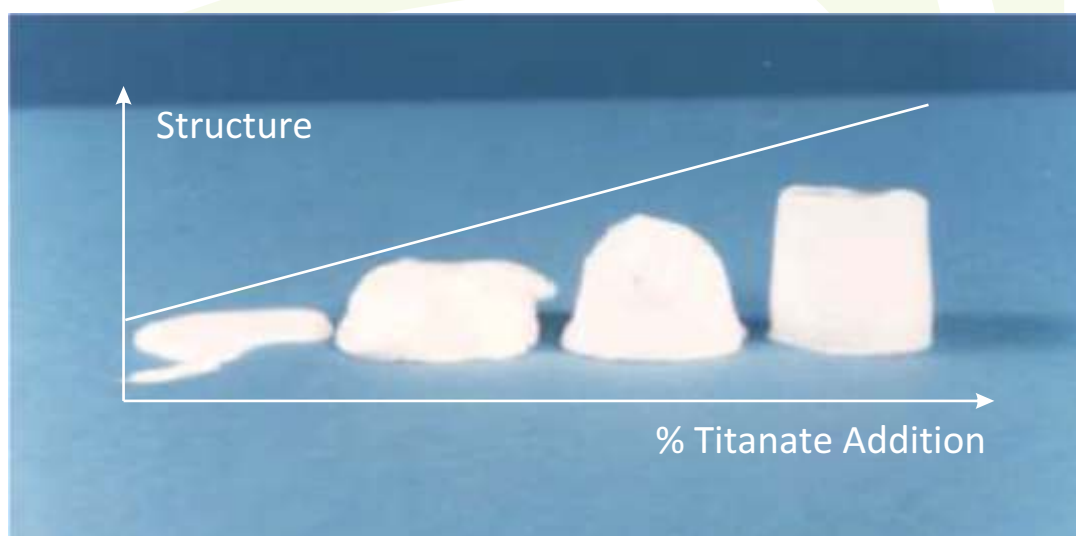
Emulsion Paints Crosslinking



Instead of all the industrial applications, PURE*ti* titanates are also suitable for consumer market, such as decorative paints. The thixotropic property of PURE*ti* TX ranges provides unique gelling strength of the emulsion paints, therefore, everyone can re-paint his or her house easily with superior covering power. The ideal brushing experience contributed by PURE*ti* TX ranges makes it possible keeping smooth leveling during painting without sagging or splashing. Such extreme non-Newtonian flow of the paint is probably all D-I-Yers looking for, which exclusively offered by PURE*ti* TX ranges. Even more, PURE*ti* TX400 is a non-VOC version among the whole ranges.

Physical Properties

Product	Appearance	Chemistry	Ti Content %	Density g/ml	Flash Point °C	Melt/Pour Point °C
PUREti TIPT	Colorless or pale yellow liquid	Tetra Isopropyl Titanate	16.8	0.96	41	Approx. 17.5
PUREti TNBT	Pale yellow liquid	Tetra n-Butyl Titanate	14.0	0.995	47	-40
PUREti TEHT	Yellow liquid	Tetra 2-Ethylhexyl Titanate	8.5	0.935	>63	-49
PUREti TET	Yellow liquid	Tetra Ethyl Titanate	20.1	1.085	30	-40
PUREti PBT	Yellow liquid	Poly Butyl Titanate	20.4	1.12	45	-25
PUREti TEAT	Yellow liquid	Triethanolamine Titanate	8.1	1.06	12	-47
PUREti TX100	Yellow liquid	Alkanolamine Titanate Complex	6.9	1.20	>71	-30
PUREti TX200	Yellow liquid		7.1	1.22	>71	-30
PUREti TX300	Yellow liquid		7.1	1.24	>71	-30
PUREti TX400	Yellow liquid		3.3	1.17	>71	-30
PUREti PN	Yellow liquid	Ammonium Zirconium Lactate Acetate	9.9	1.23	100	<10
PUREti AL	Yellow liquid	Ammonium Titanium Lactate	8.2	1.20	>70	<10
PUREti NPZ	Yellow brown liquid	Tetra n-Propyl Zirconate	20.5	1.065	23	-70
PUREti ZEA	Yellow liquid	Triethanolamine Zirconate	13.2	1.34	106	<10



Gelling structure after addition of titanate

Emission Control Catalysts

Driven by the latest environmental regulations, chemical or power plants are equipped proper facilities ensuring the exhaust gas emitted under control. Various technology can serve the requirements and it is understood using PURE*ti* titanates as precursor is commercially applicable for producing ultra fine titania carrier.

Similar technology is used by a worldwide electronic device producer. The ultra fine titania particles made by PURE*ti* titanates are successfully used for multi layers ceramic capacitors.



Sol-gel Coatings



Light metals are traditionally recognized difficult surface to be treated, such as aluminum, magnesium or titanium, which widely found on the latest electronic devices or even aircrafts. Sol-gel coatings can go beyond constrain of organic coating and provide unique performance. Hybrid with silicon and titanium, silicon and zirconium together with organic part is generally adopted for such special coatings.

Coupling Agents

Composite material formulators are always looking for the best coupling performance in their systems, so they can use less costive resins and more cheap fillers without sacrificing physical properties. PURE*ti* titanates and zirconates are the precursors for titanium based or zirconium based coupling agents for various applications.



Self-cleaning Plain Glass

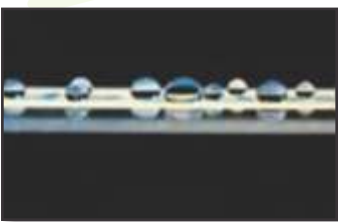


Photo-catalysis is fascinated feature applicable on construction glass. Through on-line coating process, PURE*ti* titanates are carried by hot flow and sprayed onto the glass ribbon surface at more than 600°C. The organic part is immediately broken down and evaporated. Only a nano-grade titania thin film left on the glass surface, providing the self-cleaning performance and anti-reflection performance.

Zero Expansion Glass Frit

In order to produce non expansion glass against temperature fluctuation in the environment for the highest precision photo lithography processing, giant glass producer has invented the patented glass ceramics by using PURE*ti* titanates as precursor.



Molecular Sieve

The invention of crystalline silico-titanate inorganic molecular sieve is proven to cleanup the radioactive contaminants in sea water after the tragic Fukushima Daiichi disaster. The high selectivity of this molecular sieve can remove the harmful cesium from the waste water in the nuclear power plant.



Lubricant Additive



Even automobiles are not only driven by gas today, the lubricant oil industries are still developing new formulations enhancing anti-wear performance. Among all the emerging developments by using alternative metallic compounds such as molybdenum or zinc, titanium based ones showing very promising results technically and commercially. The latest research also confirms the superior anti-wear performance with such titanium compounds by forming a nanoscale oil film on the engine metal and reducing less amount of ZDDP in the formulation.

Physical Properties

Product	Appearance	Chemistry	Ti Content %	Density g/ml	Flash Point °C	Melt/Pour Point °C
PUREti TIPT	Colorless liquid	Titanium Isopropanolate	16.8	0.96	41	Approx. 17.5
PUREti TNBT	Pale yellow liquid	Titanium n-Butanolate	14.0	0.995	47	-40
PUREti BIPT	Pale yellow liquid	Propyl Butyl Titanate	16.3	0.98	42	-39
PUREti TEHT	Yellow liquid	Tetra 2-Ethylhexyl Titanate	8.5	0.935	>63	-49
PUREti NPZ	Yellow brown liquid	Tetra n-Propyl Zirconate	20.5	1.065	23	-70
PUREti NBZ	Yellow brown liquid	Tetra n-Butyl Zirconate	20.5	1.065	35	-70

PUREti™

Organic Titanates



For further information on Polygel products, visit our website at www.polygelindia.com

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