POLYOX™

Versatile Water-Soluble Resins for Industrial Applications

Where science & creativity meet

WHAT ARE POLYOX™ WATER-SOLUBLE RESINS (WSR)?

POLYOX™ Water-Soluble Resins (WSR) are thermoplastic, non-ionic polymers with high molecular weight. They are obtained through the heterogeneous polymerization of ethylene oxide (CH2CH2O)n, which in turn creates poly(ethylene oxide) or PEO.

POLYOX™ WSR can be supplied in a wide range of molecular weights to meet specific formulation and processing requirements.

POLYOX™ WSR OFFERS A UNIQUE RANGE OF FUNCTIONAL PROPERTIES

POLYOX™ WSR exhibits many properties that are typical of other classes of water-soluble polymers:

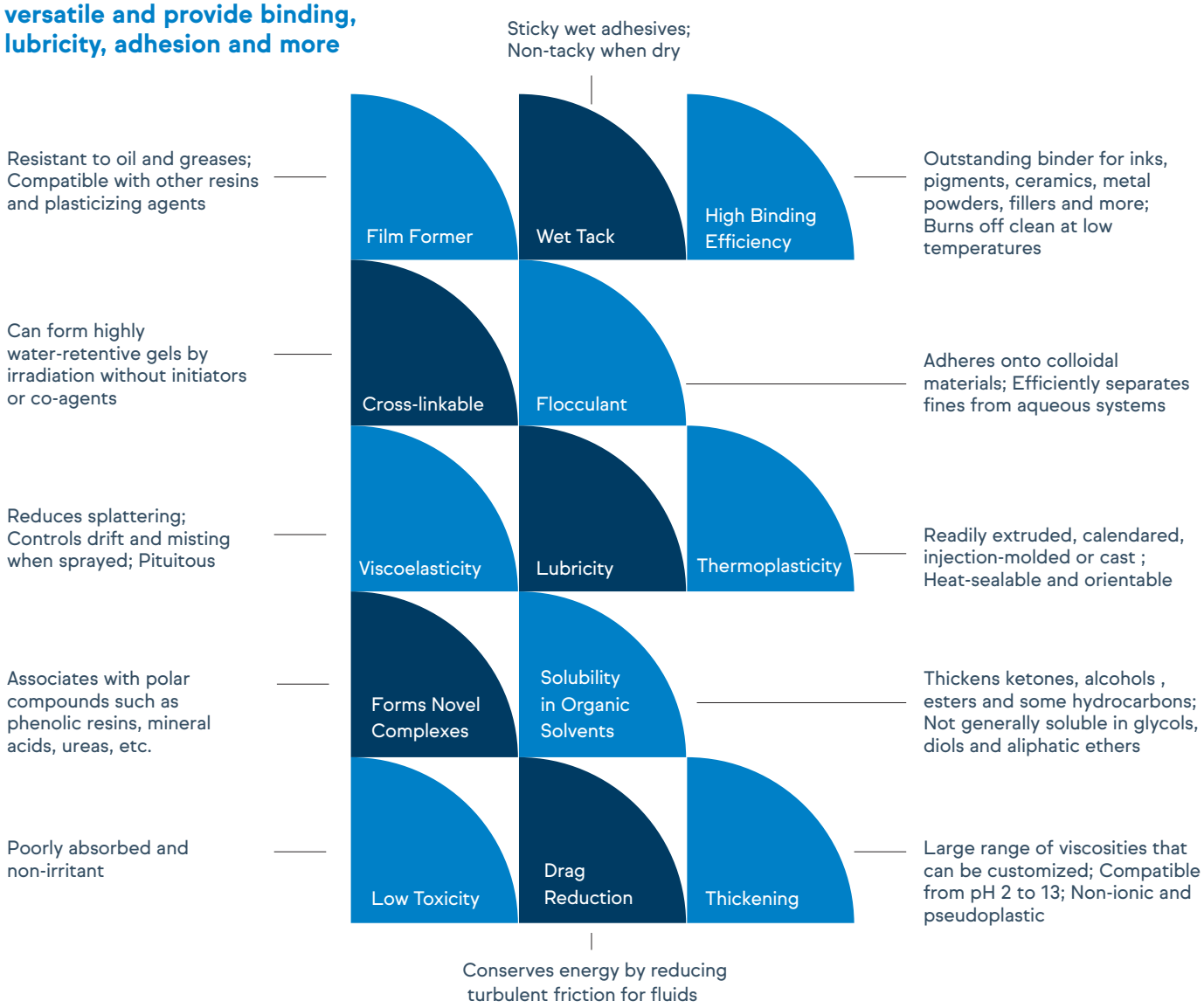
- Lubricity
- Thickening and rheology modification
- Binding
- Film formation
- Water retention

They are also unique in that they are **thermoplastic polymers** that can be calendared, extruded, injection-molded or cast.

UNIQUE PERFORMANCE PROPERTIES THAT ADD VALUE TO YOUR PRODUCTS AND PROCESSES

POLYOX™ WSR has been used for over 50 years for its unique properties. Unlike other polymers, POLYOX™ WSR combines water and solvent solubility. While thermo-elastic, POLYOX™ WSR polymers can also exhibit a thermoplastic behavior. This versatility has made POLYOX™ WSR a popular choice for many industrial applications.

Polyox™ water-soluble resins are versatile and provide binding, lubricity, adhesion and more



Films of POLYOX™ WSR are flexible, tough and resistant to most oils and greases

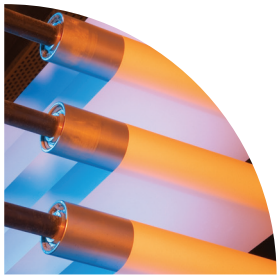
With their very high molecular weight, POLYOX™ WSR polymers are viscoelastic, so their aqueous solutions can reduce spattering and misting.

POLYOX™ WSR can also form association compounds with many other substances to achieve a wide variety of additional, useful formulation properties.

POLYOX™ WSR APPLICATIONS

At IFF, we support our customers in their efforts to develop new products, constantly solving new challenges as they arise. POLYOX™ WSR can be used in a wide range of applications and has seen increasing adoption in industrial applications.

We often customize new POLYOX™ WSR grades or chemistries to meet specific customer requirements.



Electronics

Binder in fluorescent lighting, battery electrodes and energy storage devices; Lubricant for wires, cables and optical fibers

Ceramics

Binder, forming aid and lubricant for ceramic parts, bricks, fibers and ceramic extrusion

Adhesives

Perfect wet tack for tai ltie and transfer in tissue and toweling; Low toxicity enables formulation in consumer products

Agriculture

Drift control adjuvant in crop treatment; Seed coatings and tape

Pulp & Paper

Retention aid, pitch control an d drainage enhancement in tissue, containerboard and newsprint

Mining

Flocculate clay, silica, oxidized coal fines, heavy metal ores and more; Increases dewatering efficiency

The applications mentioned above are typical of POLYOX™ WSR polymers. POLYOX™ WSR can also be used in many other applications, such as inks & coatings, release liners, automotive fluids, paper coating, textile sizing and many more.

POLYOX™ WSR PRODUCT LINE

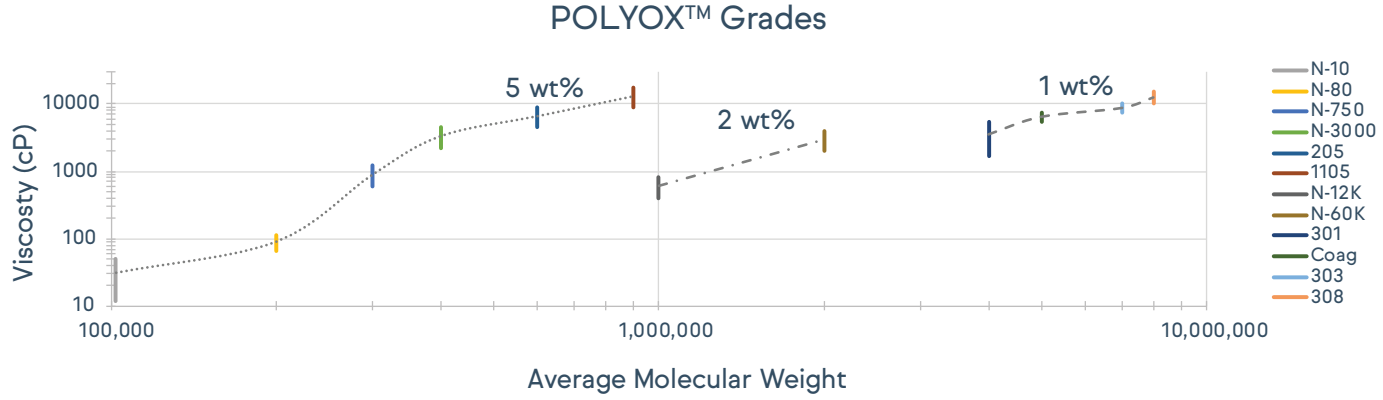
POLYOX™ Water-Soluble Resins come in a wide range of molecular weights and viscosities to meet your specific needs.

GRADES	Approximate Molecular Weight[2]	Viscosity of aqueous solution at 25 °C and given concentration, Brookfield RVF	
		wt%	mPa.s(cP)
POLYOX™ WSR N-10	100,000	5	12 - 50
POLYOX™ WSR N-80	200,000	5	65 - 115
POLYOX™ WSR N-750	300,000	5	600 - 1,000
POLYOX™ WSR N-3000	400,000	5	2,250 - 4,500
POLYOX™ WSR 205	600,000	5	4,500 - 8,800
POLYOX™ WSR 1105	900,000	5	8,800 - 17,600
POLYOX™ WSR N-12K	1,000,000	2	400 - 800
POLYOX™ WSR N-60K	2,000,000	2	2,000 - 4,000
POLYOX™ WSR 301	4,000,000	1	1,650 - 5,500
POLYOX™ WSR Coagulant	5,000,000	1	5,500 - 7,500
POLYOX™ WSR 303	7,000,000	1	7,500 - 10,000
POLYOX™ WSR 308	8,000,000	1	10,000 - 15,000
UCARFLOC™ Polymer 304 CP[2]	7,500,000	1	7,500 - 13,000
UCARFLOC™ Polymer 309 CP[2]	8,500,000	1	> 13,000

[1] Based on rheological measurements. Molecular weights obtained by other methods, including light scattering and gel permeation chromatography, may not be directly comparable.
[2] Coarse Particle (CP) grade specified as less than 15% through a 200 mesh screen (74 µm)

POLYOX™ (WSR) VISCOSITY AS A FUNCTION OF MOLECULAR WEIGHT

POLYOX™ (WSR) provides you with a one-of-a-kind toolbox, enabling you to customize viscosity according to your requirements.



PROCESSING RECOMMENDATIONS FOR POLYOX™ WSR

Although POLYOX™ Water-Soluble Resins are completely water soluble in typically 0.5 to 3 hours, dispersing the powder with minimal shear is important to facilitate complete dissolution. If the resins are added too quickly, they will form gel-coated agglomerates that prevent complete hydration. Detailed procedures and equipment recommendations for laboratory- and commercial-scale dissolving methods are available upon request.

There are three major techniques that ensure sufficient dispersion of POLYOX™ WSR resin particles, but the choice depends on the final viscosity target and required volume.

Direct addition to water

Recommended for laboratory-scale and less-than-drum quantities.

This is best accomplished by introducing POLYOX™ WSR at an adequate rate of addition. If you add it too slowly, the viscosity will build too rapidly, and you will not be able to add the remaining resin. However, if the resin is added too quickly, it will form gel-coated agglomerates.

Pre-dispersion in water-miscible non-solvents

Recommended for laboratory-scale and less-than-drum quantities.

POLYOX™ WSR is first dispersed in a water-miscible non-solvent, such as isopropyl alcohol, to separate the individual particles from each other. Each individual particle has a chance to swell, hydrate and dissolve. This technique avoids the typical clumping that occurs when dissolved in water alone. The use of alcohols or glycols has the added benefit of stabilizing the solution viscosity over time.

Use of mechanical devices that achieve dispersion with minimal shear

For large volume or continuous operations.

The relative ease of dissolving POLYOX™ WSR directly in water depends on three factors:

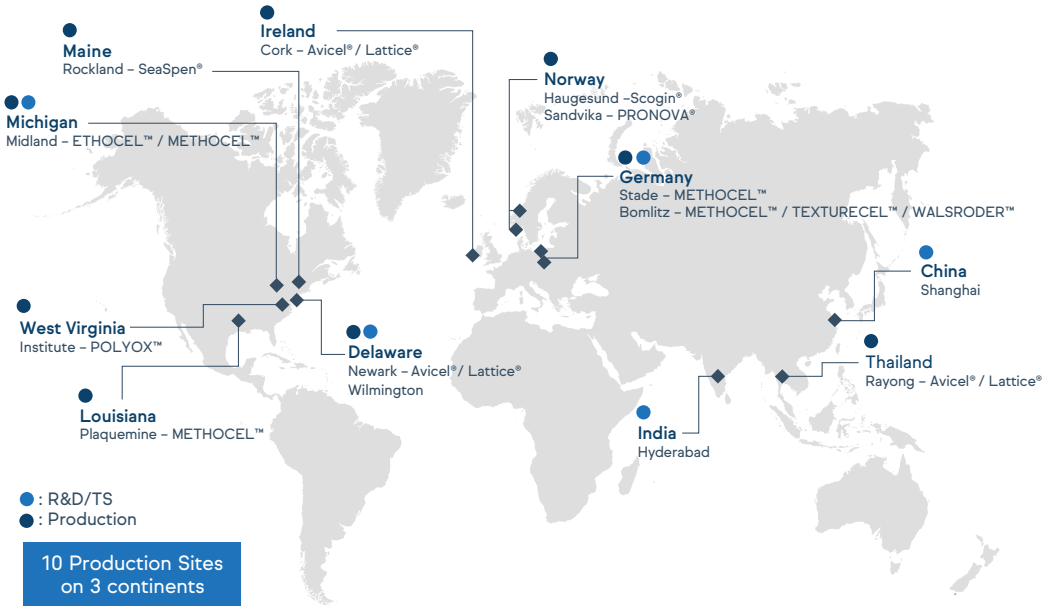
- Rate of viscosity build-up, which is a function of solution concentration and molecular weight
- Particle size
- Type of agitation; the underlying factor, once again, is to obtain good resin dispersion before the solution viscosity builds to a point where it is no longer possible to disperse additional resin

Additional information and detailed procedures, laboratory equipment recommendations and commercial scale methods for dissolving POLYOX™ Water-Soluble Resins are described in a separate brochure. Our sales and technical team can assist you with process-related questions.

GLOBAL SPECIALTY SOLUTIONS

- Global manufacturing and technology footprint
- Robust business continuity planning

MANUFACTURING & RESEARCH SITES

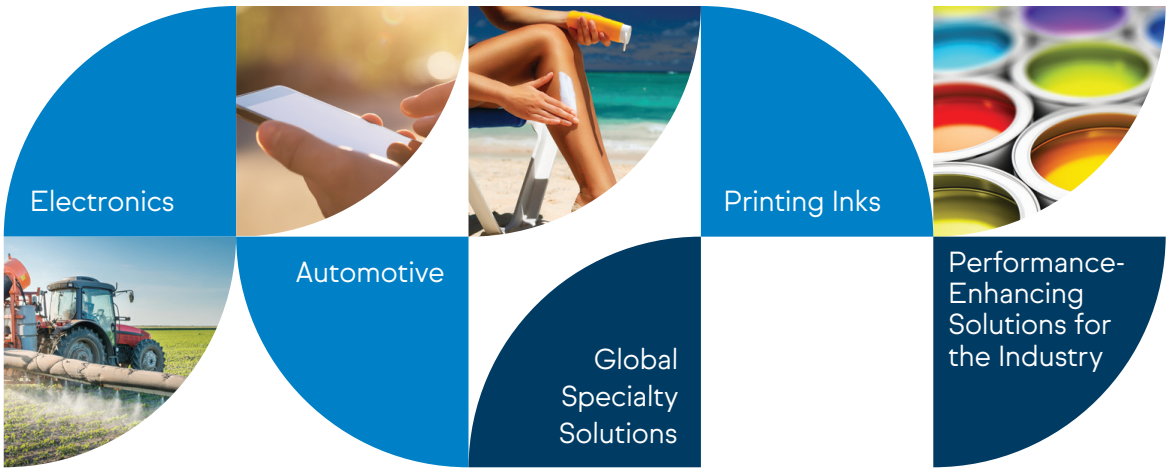


WHAT WE DO

POLYOX™ Water-Soluble Resins for industrial applications are available only from IFF and its distributors. IFF's Global Specialty Solutions business, manufactures cellulosic polymers alongside other IFF portfolio products. Our dedicated team of experts commercializes these products into various global markets.

WHO WE ARE

We are innovative problem solvers, drawing on deep application understanding and market insight to help our customers turn challenges into high-value business opportunities.



Connect with us

For more information connect with IFF sales and application experts

iff.com

Product Safety

When considering the use of any IFF products in a particular application, please review our latest Material Safety Data Sheets first to ensure that your intended use can be accomplished safely. For Material Safety Data Sheets and other product safety information, contact IFF at the provided numbers. Before handling any other products mentioned in the text, obtain available product safety information and take necessary steps to ensure safety of use.

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