



KER & KCA systems for
Windmill Blade



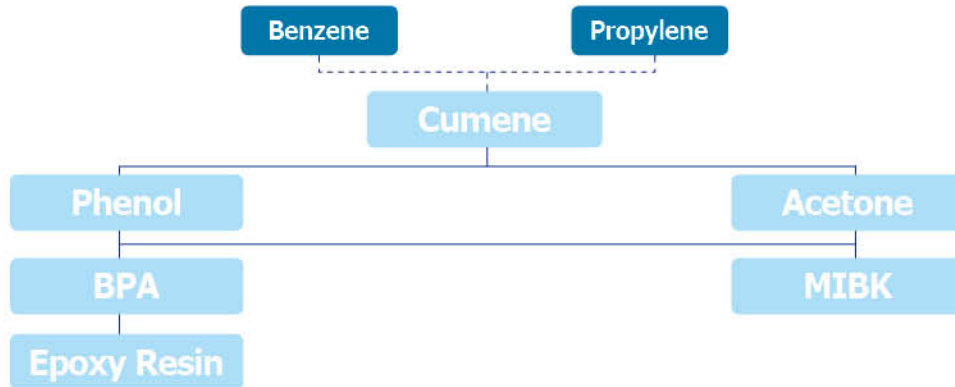
KUMHO P&B CHEMICALS



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Kumho P&B(KPB), the nation's first Phenol manufacturer, has achieved a vertically integrated structure in manufacturing petrochemical products, which range from Phenol / Acetone to Bisphenol-A, MIBK and Epoxy Resins, and has contributed to the growth of the domestic petrochemical industry with state-of-the-art technologies.

As a reliable and trustworthy supplier of industrial basic intermediates, Kumho P&B has continuously focused on the development of new technologies to achieve customer satisfaction. We are growing to become a world-leading petrochemical company by building advanced systems of quality management, preventing pollution and ensuring industrial safety, while striving for low-carbon green growth to fight against global warming, one of the world's biggest challenges.



History

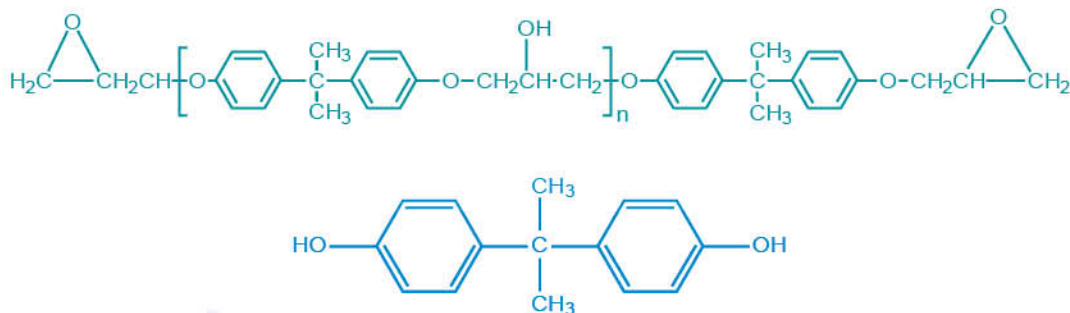
- 1976. 4 Kumho Chemical Co., Ltd. founded
- 1980. 11 Start-up of Cumene / Phenol / Acetone plants
- 1987. 6 Joint Investment Agreement with Shell (50:50, KSC)
- 1991. 1 Completion of BPA, MIBK and Epoxy resin plants
- 1998. 3 Shell withdraw from KSC / Renamed to Kumho P&B Chemicals., Inc. (KPB)
- 2000. 6 Joint Investment Agreement with Nippon Steel Chemical Co., Ltd.
- 2009. 6 Epoxy System for windmill blade approved by Germanischer Lloyd
- 2010. 8 Epoxy adhesive systems for windmill blade approved by Germanischer Lloyd
- 2014. 6 Epoxy(LER) plant expansion to 135,000 MTA

World Leading Technology and Eco-friendly Management

Since Kumho P&B Chemicals was designated as an Environmentally-Friendly Company by the Korean government in 1999 for its recognition of the importance of eco-friendly management, the company has focused on investing in Research and Development related to green projects, such as energy-saving by minimizing process waste energy, the reduction of CO₂ emissions, and the introduction and development of new eco-friendly processes and products.

Kumho P&B's efforts were recognized again in 2002, when the company won the Grand Prize in Environmentally-Friendly Management from the Ministry of Environment. What's more, Kumho P&B was selected as a quality-competitive excellent enterprise in successive years, recognition of its advanced technology and operational know-how in this field.

Kumho P&B Chemicals is now ready to present a significant technological innovation with our windmill blade manufacturing system. To provide greater support for blade manufacturers, our energetic and professional R&D will develop innovative new raw materials in order to improve customers' processes, and will continue to contribute expertise and knowledge to help customers and industries to achieve mutual benefits. In addition, our integrated product lines in the areas of Phenol, Acetone and Bisphenol-A will supply more competitive goods. Kumho P&B's KER & KCA systems for windmill blade manufacturing will be the best solution to achieve your technology innovation.



Harmonious KER & KCA systems for windmill blade

Kumho P&B Chemicals provides harmonious solutions for specific requirements, and always supports our customers. To satisfy our customers, Kumho P&B's technicians provide support using highly advanced technologies. Customers can make the best windmill blades that achieve target performance levels, with high stiffness and flexibility, and excellent strength, heat resistance, and durability. Our KER & KCA system will give you an opportunity to experience great change in the windmill blade business, providing increased durability and weather resistance, and improving your manufacturing systems.



◀ The Germanischer Lloyd Certification ▶

KER & KCA Epoxy systems are approved by Germanischer Lloyd, and international technical monitoring group that stands in the forefront of testing, researching and continuous improvement of safety factors.



KER & KCA infusion systems 9100

Systems	mixing ratio		Mixed viscosity at 25°C (cps)	Gel time at 25°C, 100g(min)	T _g (°C)	Tensile strength (MPa)	Flexural strength (MPa)
	part by weight	Part by volume					
KER 9100 : KCA 9110	100 : 30	100 : 37	200~300	450~550	85~100	65~80	110~125
KER 9100 : KCA 9120	100 : 30	100 : 37	200~300	350~450	85~100	65~80	110~125

For the manufacture of structural composites such as:

- Wind turbine blades
- Turbine nose cones
- Generator nacelles and fairings

The KER & KCA infusion systems consists of an epoxy resin and variety of amine curing agents designed for the vacuum-assisted resin infusion molding process. The systems are particularly suitable for the production of large, fibre-reinforced, composite parts that require a proper gel time and a curing condition. The fully-cured system has excellent mechanical and thermal properties, and can meet customer's requirements.

KER & KCA mold building systems 9200

Systems	mixing ratio		Mixed viscosity at 25°C (cps)	Gel time at 25°C, 100g(min)	T _g (°C)	Tensile strength (MPa)	Flexural strength (MPa)
	part by weight	Part by volume					
KER 9900 : KCA 9910	100 : 31	100 : 39	200~500	300~400	100~140	70~85	115~130
KER 9900 : KCA 9920	100 : 28	100 : 36	200~500	150~250	100~140	70~85	120~135

For making composite molds by:

- Vacuum Assisted Resin Transfer Molding (VARTM)
- Resin Transfer Molding (RTM)

The KER & KCA mold building systems consists of one epoxy resin and two amine curing agents. It provides an excellent balance of properties for gel time and in-mold reactivity. The low viscosity of the resin systems result in excellent flow properties and fibre wetting. The fully cured resin system exhibits excellent mechanical and thermal properties.

KER & KCA hand lay-up systems 9500

Systems	mixing ratio		Mixed viscosity at 25°C (cps)	Gel time at 25°C, 100g(min)	T _g (°C)	Lap shear strength (MPa)	Creep deformation (MPa)
	part by weight	Part by volume					
KER 9500 : KCA 9510	100 : 39	100 : 45	900~1300	15~35	120~135	80~95	135~150
KER 9500 : KCA 9520	100 : 27	100 : 34	900~1300	30~100	110~125	80~95	130~145

For the manufacture, assembly and repair of structural composites such as :

- Wind turbine blades
- Turbine nose cones
- Generator nacelles and fairings
- High performance laminates

The KER & KCA hand lay-up systems are designed for hand-laminating, repairing components for high static and dynamic loads. It consists of an epoxy resin with a variety of amine curing agents for different gel time. The viscosity of the system is optimized to offer the appropriate balance between application properties and fibre wetting. The fully cured property exhibits excellent mechanical and thermal properties.

KER & KCA adhesive systems 9900

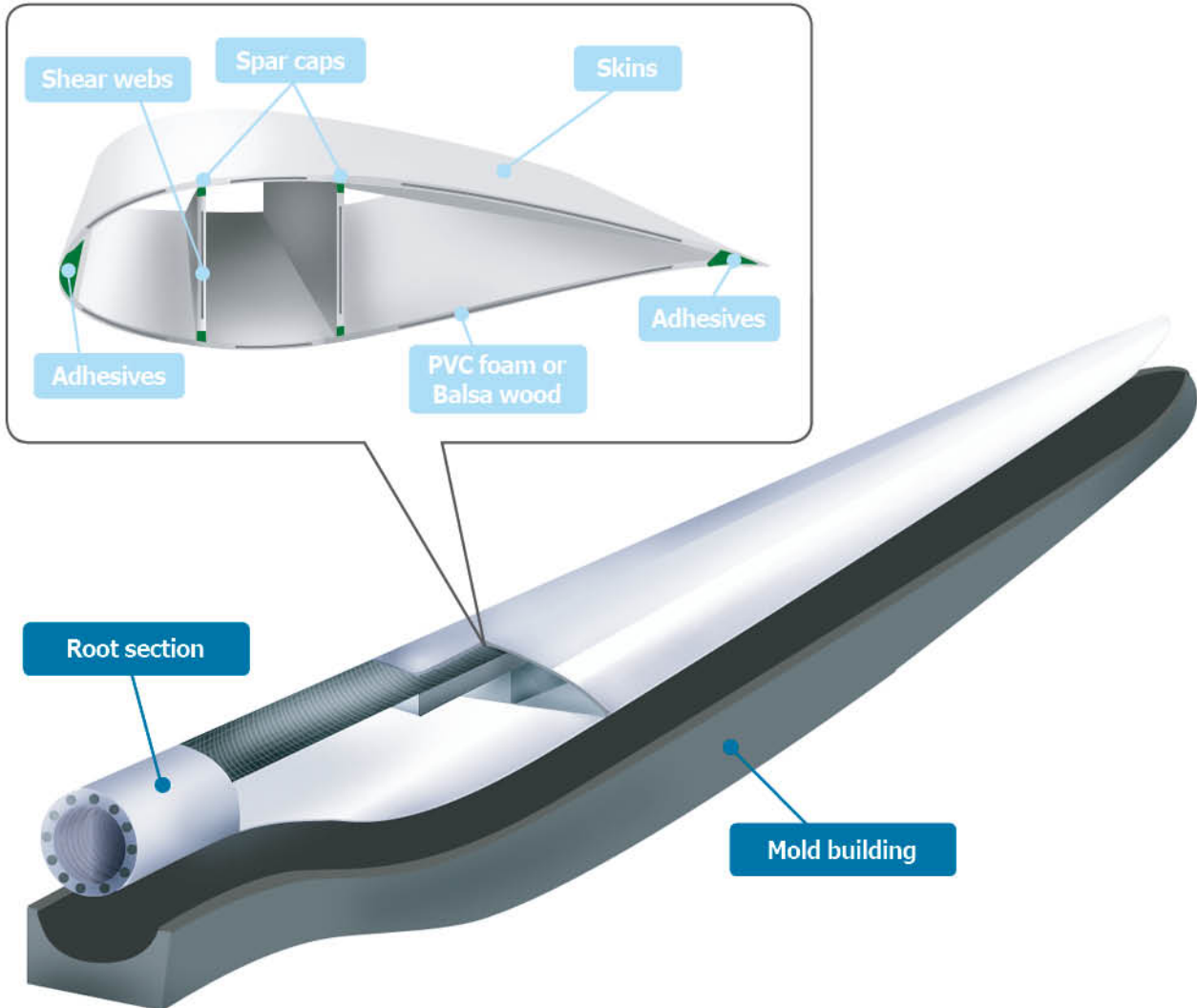
Systems	mixing ratio		Mixed viscosity at 25°C (cps)	Gel time at 25°C, 100g(min)	T _g (°C)	Lap shear strength (MPa)	Creep deformation (MPa)
	part by weight	Part by volume					
KER 9900 : KCA 9910	100 : 45	100 : 50	Thixotropic	80~120	90~110	>12	< 0.05
KER 9900 : KCA 9920	100 : 45	100 : 50	Thixotropic	150~250	80~100	>12	< 0.05

For making huge scale assembly such as :

- Wind turbine rotor blade
- Boat building
- FRP material assembly

The KER 9900 adhesive systems are epoxy based bonding paste for huge scale buildings that are need to be high performance. This bonding material provide various working time for customer's process.

- Work efficiency for better productivity
- More reliability for resin technology
- High quality material from raw material(Phenol, Acetone, BPA)
- Good mechanical and physical performance for large scale buildings



Systems	Process	Applications
KER 9100	Blade Infusion	Root section, Shear webs, Spar caps, Skins
KER 9200	Mold Infusion	Mold building
KER 9500	Hand Lay-up	Root section, Shear webs, Spar caps, Skins
KER 9900	Adhesion	Adhesives

KER & KCA systems for **Windmill Blade**

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