

نوماء
NAMA



للكيمياءات CHEMICALS

EPOXY RESINS,
NUMBER ONE IN
CORROSION RESISTANCE

Presented to
1st Jubail Corrosion Conference
Oct. 2010

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NAMA Chemicals



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NAMA CHEMICALS

- NAMA is a Saudi joint Stock Company
- Operating since 1995.
- Total assets: SR. 2.54 Billion
- Paid up capital: SR. 1.285 Billion
- Company Head Office : Jubail Industrial City
- Total number of Employees: 384
- Operating units:

1. ARABIAN ALKALI COMPANY (SODA)



Solid Caustic Soda 50,000 MT/Year

2. JUBAIL CHEMICAL INDUSTRIES (JANA)



- Epoxy Resins 60,000 MT/Year
- Epichlorohydrin 30,000 MT/Year
- Caustic Soda (liquid) 70,000 MT/Year
- Hydrochloric Acid 38,000 MT/Year
- Calcium Chloride 50,000 MT/Year

Registered trade mark of Jana

Razeen® رزبين

Araldite *

Oldest Epoxy Brand Originally Registered by
Ciba in 1947

* Araldite is a TM of Huntsman

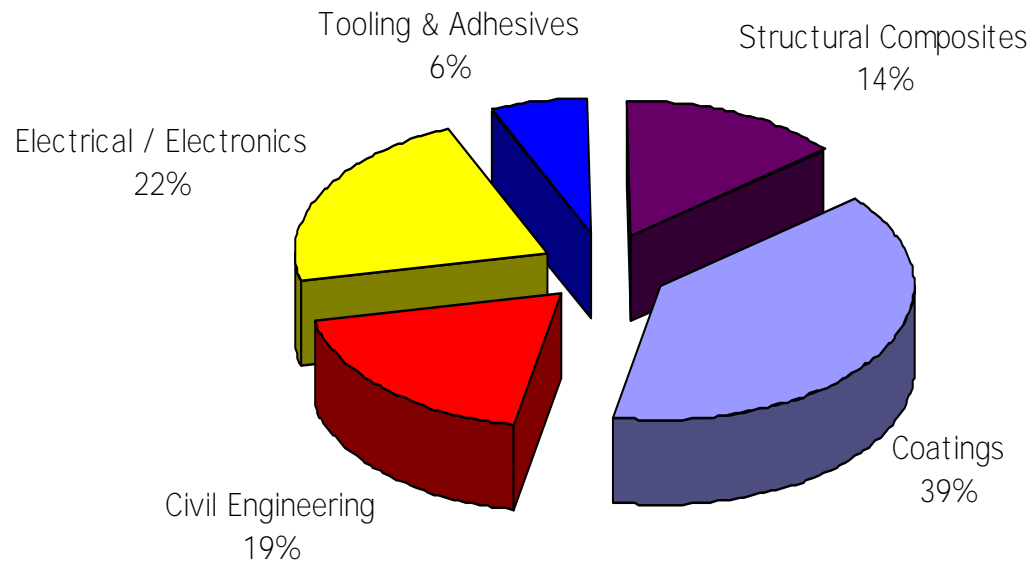
Epoxy Resins

Found by C. Castan in 1930s on his search for dental use and successfully introduced by Ciba by end 1940s in the electro industry as insulating material, as coating and laminating material, as well as adhesive.

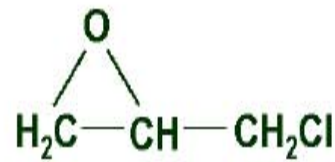


Demand and Applications for Epoxy

Global Demand ~ 1,600,000 MT per Year

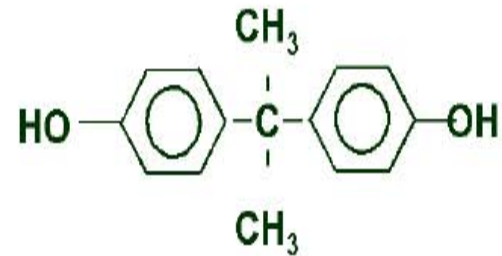


EPOXY CHEMISTRY

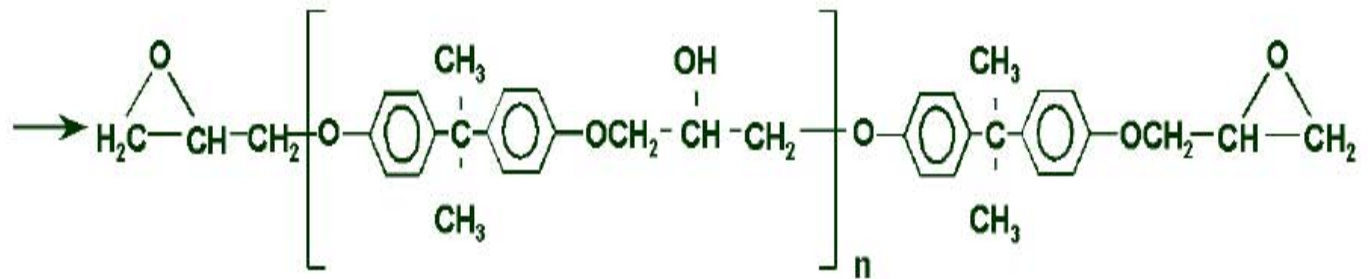


Epichlorohydrin

+

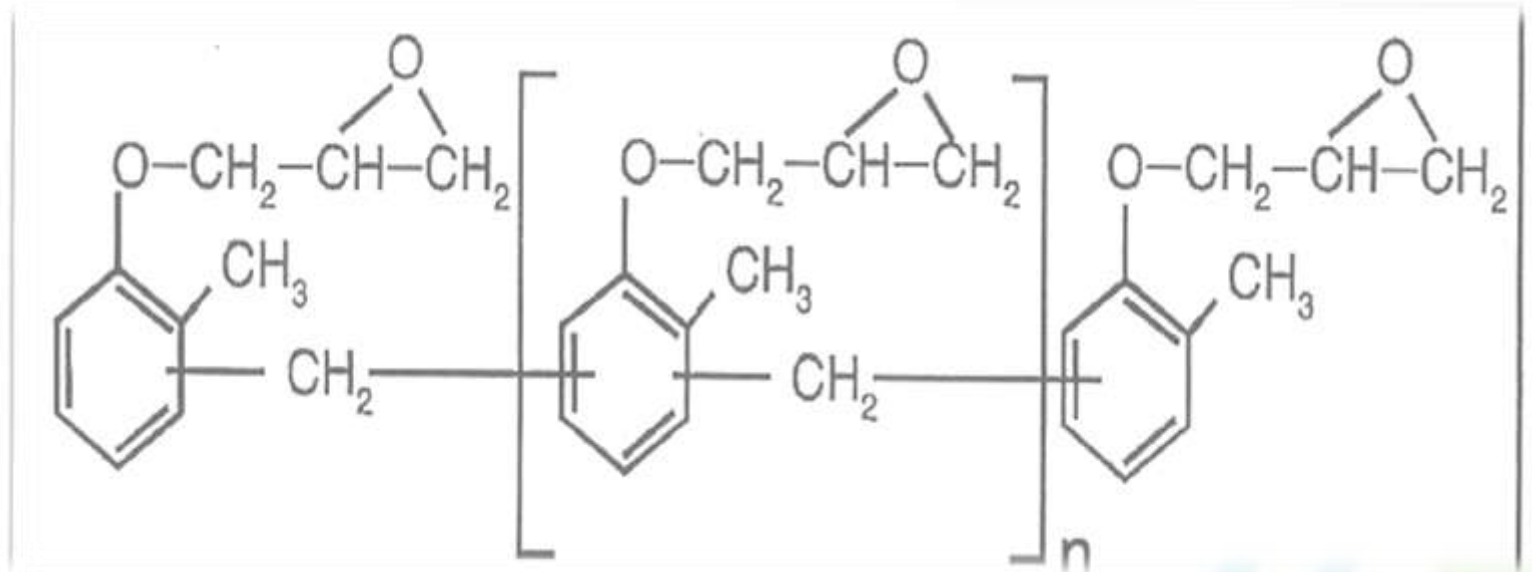


Bisphenol A



Base Epoxy Resin (n = 1 to 15)

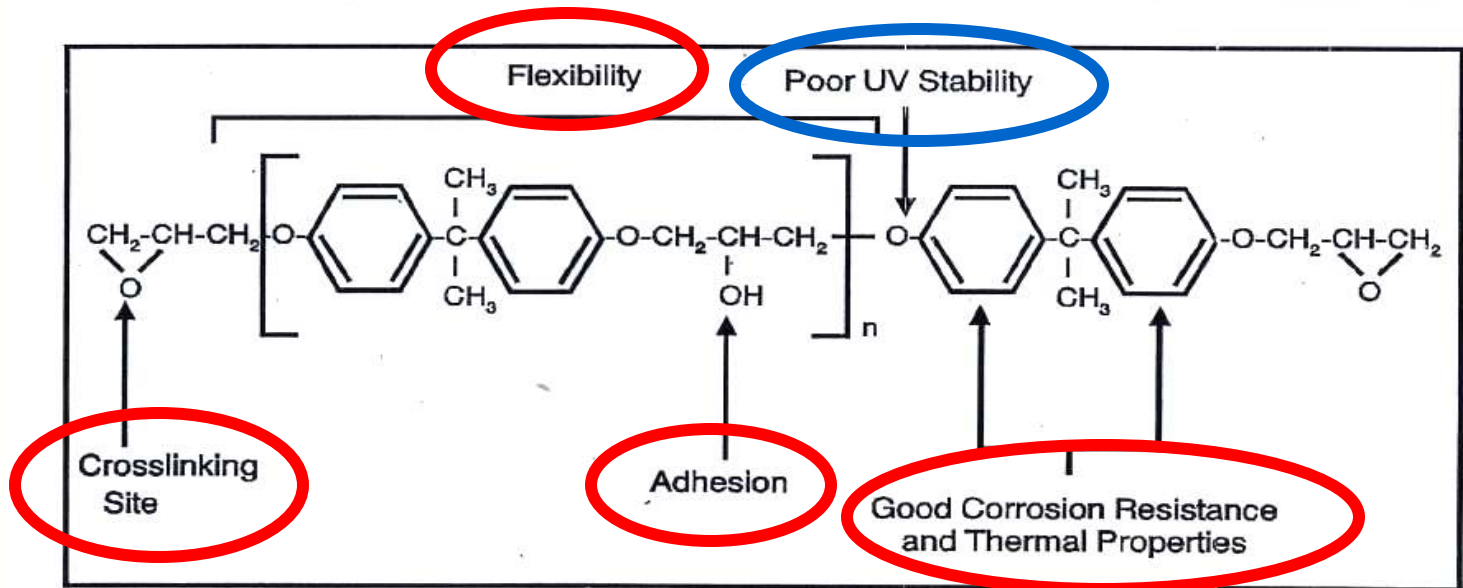
Improved Epoxy Resins, the: Epoxy Cresol Novolac (ECN)



- In the mid sixties, new multi functional epoxy resins of phenol novolac or cresol novolac were introduced in the market.
- The chemistry of these resins is very similar to that of Bisphenol-A type resins.
- The main purpose of using these resins was to improve the cross linking density of the formulation.

What makes epoxy resins special

Structure/Property Relationship



Bisphenol-A Epoxy Resin

The aromatic structure of the resin implements a strong hydrophobic performance far over competitive resins like polyurethanes or acrylics, which were developed at the same time.

Corrosion resistance

Epoxy based formulations give corrosion resisting coatings or laminates .

- Absolutely non porous
- Tough and resistant to impact
- Flexible enough to withstand expansion without damage due to temperature changes
- Excellent adhesions on various substrates
- Film thickness is adaptable
- Highly resistant to chemicals, solvents, moisture and elevated temperatures
- Film-forming time is as short as possible
- Long pot life of room temperature curable systems
- Easy to apply

Other advantages of epoxy systems

- Excellent adhesion
- Low shrinkage on cure typically $< 3\%$
- Excellent water, heat and chemical resistance
- Versatile (formulations can be tailor made to the needs)
- No release of volatiles during curing (addition reaction)

Corrosion resistance improvement

- The performance of epoxy resins can be improved by selecting the proper hardeners, pigments, fillers and suitable additives



Environmentally Friendly Epoxy Formulations

- Epoxy based coatings are reformulated into ecologically acceptable and energy saving systems without losing their excellent corrosion resistant performance.
- Instead of organic solvents, water was used, which was cheap, non-flammable and non-toxic. Such epoxy coating systems, dissolved or dispersed in water have for a long time captured a substantial share of the market as **electro-deposition primer for car bodies**



Corrosion protection of crude oil tanks

- The complete absence of volatile components in combination with liquid epoxy resins, reactive diluents and low viscose hardeners makes it possible to formulate coatings – or reinforced with glass fibres as laminates – with high corrosion resistance performance to protect the inside of storage tanks for crude oil and other chemicals.
- Several tank farms in the Middle East have been successfully coated many years ago and are still functional.



Corrosion protection of ship ballast tanks

This highly corrosive environment requires a rugged epoxy coating, designed for immersion service in salt water ballast tanks and fuel/sea water ballast tanks.



Corrosion protection in Civil Engineering

- Quartz sand filled systems enable the application as mortar or self-levelling flooring.
- These cold curing systems are applicable even under unfavourable conditions, such as at temperatures close to the freezing point, high humidity and even under water.



Powder Coatings

- The electrostatic application of a fine pulverized, completely solvent free, solid epoxy resin/hardener system in the early seventies was
a real break through in the coating industry!
- The higher molecular weight resins (1200 – 1800), based on Bisphenol-A were predestined to be suitable for their outstanding performance in having a low melting point and viscosity and various functionalities.
- High purity and practically no gelled particles which would deteriorate the final quality of the coating.

Powder Coatings

- Quality metal substrates like furniture and kitchen appliances, gardening equipment, sport goods as well as parts under the hoods of the car body are powder coated.
- The automotive industry additionally offers significant increase potential regarding on-line surface primer as a second layer on top of the electro-deposition primer with excellent corrosion and stone chip resistance.
- Due to their excellent anti corrosion properties, high reactive powder systems are mainly used to protect steel pipes transporting water, oil or gas.

Powder Coatings

- In general the performance of the powder coatings is influenced by several factors depending on the epoxy resin types:
 - Average molecular weight
 - Molecular distribution
 - End-group functionality VS epoxy content
 - Degree of chain branching
 - Compatibility with the co-reactant
 - Easy homogenization in the extruder.

Corrosion protection in Civil Engineering (Powder Coating)

Reinforced steel bars embedded into concrete can corrode because of chloride attack, carbonation effect and humidity in a marine and coastal environment.

This takes place if the alkaline environment surrounding the bars slowly changes with reduction of pH-value from 12.7 to under 8.4.

The rust products of corroding steel bars occupy much more volume than that of original steel and the expansion pushes out the concrete cover and causes cracks.



Corrosion protection in Civil Engineering (Powder Coating)

The protection of such rebar with suitable epoxy powder coating prevents such corrosion



Corrosion protection in Civil Engineering



Millions of tons of rebar have been successfully coated and applied in concrete constructions (Oil drilling platforms, King Fahad-causeway ..etc).

