Advanced Materials

Araldite® HCEP Systems

Hydrophobic epoxy for extreme outdoor conditions
Epoxy systems for tough climatic environments

Araldite® HCEP (Hydrophobic Cycloaliphatic Epoxy) Systems have been developed to meet and exceed the stringent requirements of medium to high voltage outdoor applications. The durable outdoor insulation systems offer high performance and reliability in tough climatic environments combined with the strength of traditional epoxy systems.

Extended hydrophobic properties

- Intrinsic hydrophobicity
- Hydrophobicity transfer
- Hydrophobicity recovery
- Long-term stability of hydrophobicity

Benefits for the manufacturer

- Extended hydrophobic properties
- Low leakage currents
- Superior thermal cycle resistance
- Enhanced flame retardancy
- Excellent tracking and erosion resistance
- Extended insulator life time expectation
- Construction and insulation material for monolithic insulators
- Advanced design flexibility
- Lower cost over lifetime of the insulator

Exceeding worldwide requirements

Araldite® HCEP Systems are used in outdoor applications worldwide. Electrical equipment manufactured with this material has received key utility approvals, such as EDF, ESKOM and KEPCO. Araldite® HCEP Systems are proven in extreme situations and have passed one of the most aggressive natural aging tests for outdoor applications: KIPTS (Koeberg Insulator Pollution Test Station) in South Africa.

Extended hydrophobic properties

Hydrophobicity recovery effect

Hydrophilic surface

Hydrophobic surface

The hydrophobicity recovery effect is the ability of surfaces to recover their initial hydrophobic properties after losses resulting, for example, from electrical aging.

Hydrophobicity transfer effect

Hydrophilic pollution

Hydrophobic pollution

The hydrophobicity transfer effect is the ability of surfaces to turn hydrophilic pollution into hydrophobic layers.

Current transformer KOR 50 made with hydrophobic Araldite® CY 5622 – with courtesy of ABB USA
Insulation materials for new ABB outdoor vacuum reclosure OVR

ABB reclosures made of Araldite® HCEP Systems have passed one of the most stringent natural aging tests for outdoor applications: KIPTS in South Africa.

With dry summers, high winds, high exposure to UV radiation, seasonal rainfall and extremely heavy levels of marine and industrial pollution like salt, KIPTS is recognized worldwide as one of the harshest natural aging test sites.

The reclosers made from Araldite® HCEP Systems were tested over one year. Results are:

> No signs of material erosion, tracking, cracks or punctures
> No more than one instance of insulation leakage current exceeding 750 mA (only three instances allowed)
> Heavy to very heavy pollution test passed
> Testing for use in marine and industrial environments passed

Conclusion

“Araldite® HCEP … – the best commercially available dielectric material for enhanced performance in severely polluted outdoor environments.”

(ABB Review 4/2008)
## Comparison of medium-voltage outdoor insulators

<table>
<thead>
<tr>
<th></th>
<th>HCEP Aralite+HCEP Systems</th>
<th>Silicone (composite insulator)</th>
<th>EPDM (composite insulator)</th>
<th>CEP Standard cyclo-aliphatic epoxy</th>
<th>Porcelain</th>
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<tbody>
<tr>
<td>Design versatility</td>
<td>⬤ ⬤ ⬤ ⬤ ⬤</td>
<td>⬤ ⬤ ⬤ ⬤</td>
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<td>⬤ ⬤ ⬤ ⬤</td>
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<td>Bird attack resistance</td>
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<td>Tracking and erosion resistance</td>
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<td>Flame resistance</td>
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<td>Insulator cost</td>
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<td>⬤ ⬤ ⬤ ⬤</td>
<td>⬤ ⬤ ⬤ ⬤ ⬤</td>
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<tr>
<td>Overall insulator life cost</td>
<td>⬤ ⬤ ⬤ ⬤ ⬤</td>
<td>⬤ ⬤ ⬤ ⬤</td>
<td>⬤ ⬤ ⬤ ⬤</td>
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</tbody>
</table>

- ⬤ ⬤ ⬤ ⬤ ⬤ = excellent
- ⬤ ⬤ ⬤ ⬤ = very good
- ⬤ ⬤ ⬤ = good
- ⬤ ⬤ = medium
- ⬤ = critical
- ⬤ = very critical
Fluorescent UV aging test
Standard cycloaliphatic epoxies lose hydrophobicity after 5,000 hours whereas Araldite® HCEP Systems even increase hydrophobicity due to higher roughness (lotus leaf effect). 1,000 standard sun hours fluorescent UV correspond to 1 year in nature.

Accelerated weathering

Lower leakage currents
1,000 hours salt fog test according to IEC 61109: very low leakage currents
During a 1,000 hours salt fog test, the Araldite® HCEP Systems show lowest leakage currents in comparison to standard cycloaliphatic epoxy systems. They provide extended insulator lifetime due to lower discharging activity and lower risk for flashovers. (Tested at FETI, Hungary)

Enhanced thermal cycling resistance
Araldite® HCEP Systems help designers to create applications for lowest temperatures.

Track record, tests and approvals
> Suited for railway tunnel applications (NF standard 16-101/16-102)
> Key utility approvals: EDF, ESKOM, KEPCO
> Passed KIPTS test (Koeberg Insulator Pollution Test Station) in South Africa
> Worldwide experience
> Successfully tested by key institutes:
  > FETI (Furukawa Electric Institute of Technology), Hungary
  > FGH Engineering & Testing GmbH, Mannheim, Germany
  > Technical University Braunschweig, Germany
  > Utsonomiya University, Japan
> Featured in key publications from Huntsman, ABB and third parties

Araldite® HCEP Systems
Standard cycloaliphatic epoxy system

Lower leakage currents

Enhanced thermal cycling resistance

Araldite® HCEP Systems help designers to create applications for lowest temperatures. The Embedded Pole OP1 – Outdoor from ABB has passed a thermal cycle test down to -80 °C.
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