New Findings and Experiences with GtL Transformer Oil

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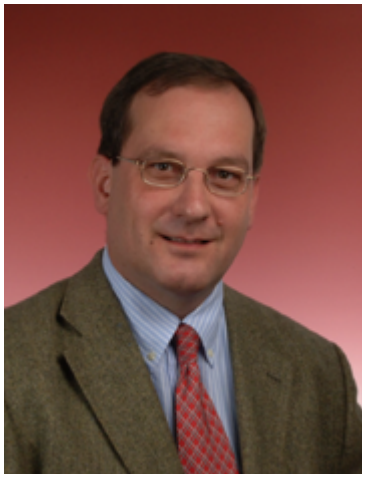

Dr. Joerg Friedel studied Technical Chemistry at the Technical Colleague in Merseburg and the University of Aberdeen/Scotland. His PhD project was about environmental chemistry.

Mr. Friedel joined Shell in 1995 and got experiences in the application of lubricants and transformer oils, and the manufacturing and use of base oils. He works now as a Global Product Application Specialist for electrical oils and is responsible for technical support for transformer oil customers globally. He is located at Shell´s research laboratory in Hamburg.

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Dr. Joerg Friedel, Product Application Specialist Transformer and Turbine Oils

Shell Global solution

Summary: GtL based transformer oil is now available for some time. It has proved its ability to perform well in praxis tests. Nevertheless, additional laboratory tests uncovered some additional advantages, like cooling properties, high voltage impulse breakdown voltage and foaming properties. It could be proved that DGA can be applied a that Diala S4 ZX-I is fully compatible with traditional mineral oils.

GtL transformer oil is now for one year commercially available as Diala S4 ZX-I. Therefore some practical experiences are available, but also the laboratory evaluation did not stop. The main advantages of GtL based transformer oils are:

- Excellent oxidation stability (exceeding IEC 60296 §7.1 limits)
- High flash point (> 190 °C)
- Absence of sulphur compounds (below detection limit ASTM D 5185)
- Reasonable pour point (-42 °C) without the use of pour point depressant additives

The good oxidation stability can be explained by the isoparaffinic structure of the oil.

Another parameter what was additionally explored was the high voltage impuls breakdown voltage. It could shown that with Diala S4 ZX-I higher voltages could be achieved.

Cooling properties where another point for investigation and tests. By modeling a tube flow it could be estimated, that the heat transfer coefficient of GtL fluids is slightly higher compared to naphthenics. This could also be confirmed by an heat run test on a real distribution transformer, where smaller temperature gradients with Diala S4 ZX-I proved the better heat transfer capability in comparison to a traditional oil.

As important information about the transformer function can be obtained from the analysis of dissolved gases certain transformer failures has been simulated in the laboratory. It was found, that in general the flammable gas concentrations in GtL based transformer oils are lower than for traditional oil. But the ratios of the gas concentrations are still almost the same, so widely used interpretation schemes as the Duval triangle can still be used. This was also proved in an practical example.

The use on a manufacturer production site showed, that the lower foaming tendency could be of advantage during transformer filling.

As GtL fluid is an hydrocarbon it is fully compatible with traditionally oils. This was proved in many tests, what also showed the ability of Diala S4 ZX-I to improve the oxidation stability of an used oil when added in rather low concentrations.

Shell Diala S4 ZX-I is approved by many transformer manufacturers and utilities and was tested by many laboratories around the globe.

Zusammenfassung: GtL basierte Transformatorenöle sind jetzt bereits einige Zeit kommerziell verfügbar, Shell Diala S4 ZX-I hat seine Leistungsfähigkeit in vielen Praxisanwendungen unter Beweis gestellt. Darüber hinaus konnten eine zusätzliche Vorteile ermittelt werden, wie Kühleigenschaften, Beständigkeit gegenüber Hochspannungsimpulsen oder die geringe Schaumneigung. Es konnte festgestellt weden, dass Diala S4 ZX-I verträglich ist mit traditionellen Transformatorenölen auf Mineralölbasis.

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