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SUPERIOR STABILITY PERFORMANCE OF FISCHER-TROPSCH (FT) KEROSENE

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In the application of kerosene as aviation turbine fuel in modern aircraft, the fuel is increasingly used as the primary coolant for various aircraft systems, thereby increasing the thermal stress that the jet fuel is exposed to. In the quest for increased efficiency of aircraft engines, the engines are operating at higher a temperature than before, which increases the importance of thermal stability of the fuel. The importance of good thermal stability of jet fuel has resulted in the establishment of a specific thermal stability specification and test method, the ASTM D3241 Jet Fuel Thermal Oxidation Tester (JFTOT) procedure conducted at 260 °C. The current Jet A-1 specification requires the fuel to pass the test at a test temperature of 260 °C, but work is in progress to change the specification to report break point temperatures in future. Storage stability is also important especially in military applications since these fuels may be stored for extended periods of time. Hydrotreated fuels and synthetic kerosenes, which generally lack natural antioxidants, require the addition of synthetic antioxidants such as hindered phenols to limit oxidation and hydroperoxide formation in the fuel during long-term storage.

In recent years there has been increasing interest in alternative sources of fuel to supplement crude oil-derived fuels. The development of Fischer-Tropsch (FT) jet fuel has progressed to the point where Sasol's fully synthetic jet fuel has been approved for commercial use as published in DEFSTAN 91-91, Issue 6 in April 2008. Since FT fuels are expected to have inherently good thermal and oxidative stability due to their negligible quantities of heteroatomic species, olefins and aromatics, a study was undertaken to evaluate the JFTOT break point temperatures and storage stability properties of various Sasol FT kerosene streams. It was found that these streams generally exhibit superior JFTOT break point temperatures.

This paper summarises the results obtained during the evaluation of the JFTOT break point temperatures of FT kerosenes in comparison with crude oil-derived Jet A-1, including their respective storage stability results. The significant enhancement in thermal stability that was found due to clay treatment is also discussed, while possible reasons for the observed superior thermal stability of FT kerosene are postulated.