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POTENTIAL OF ALTERNATIVE FUELS FOR AIRCRAFT: FOCUS ON THERMAL AND OXIDATION STABILITY

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Fuel availability at a reasonable cost seems more and more uncertain. While energy demand remains high, peak oil is expected to be seen in the coming years; as an aggravating factor, the production areas are concentrated within politically unstable countries. Moreover, climate change implies that greenhouse gases emissions should be reduced. In that context, the search for alternative fuels for aircraft seems to be a promising solution. Nevertheless, aeronautics represents a very specific and constraining transportation mode, due to its usage (short range, middle range, long range with the same fuel, worldwide distribution of the fuel...) and its compulsory security constraints. The properties of Jet fuel can be divided into three main families: properties linked to the combustion, properties linked to the use at high altitude and the last group is about storage and safety. The stability specified in DEF STAN 91/91 is measured by JFTOT (Jet Fuel Thermal Oxidation Tester) and shows the tendency of the product to form deposits on a metallic surface at high temperature.

The present work is dedicated to evaluate the thermal and oxidation stability of potential alternative fuels for aircraft. The alternative fuels tested in this work are blends of conventional Jet fuel with alcohol, or esters and also BtL product. Three different techniques are used: JFTOT, MicroCoking and PDS (Pressurized Differential Scanning). JFTOT is the conventional technique used in international specifications. The MicroCoking bench test is a method commonly used to qualify engine oils and allows to evaluate thermal stability. And the last test, PDS, covers the determination of the stability under accelerated oxidation conditions. This work shows that the combination of these different techniques allows to better understand the oxidative and thermal stability of alternative fuels.

KEYWORDS: Jet fuel, Alternative fuel, BtL, FAME, Alcohol, Thermal stability, Oxidation stability, MicroCoking