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STUDY OF THE OXIDATION OF THE MAIN HYDROCARBON FAMILIES CONTAINED IN THE KEROSENE JET A-1

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In modern aircraft, on board fuel is used not only for propulsion but also as a primary coolant. Thus, in the fuel system and injection devices, the fuel temperature can increase significantly. This thermal stress conjugated with the presence of dissolved dioxygen can lead to the formation of gums and solids. These deposits can cause fouling of nozzles and heat exchangers.

As kerosene Jet A-1 is a complex blend of hydrocarbons, containing at least 300 components, it is difficult to determine from which hydrocarbons the deposits come from. But, when taking a closer look, all the hydrocarbons can be classified in 3 main families: alkanes (linear and branched), cycloalkanes (mono or bi-cyclic) and aromatics (mono or bi-cyclic). The objective of this work consists in studying and determining the behaviour under oxidative conditions of, at least, one molecule representative of each hydrocarbon family of the Jet A-1.

This study is carried out with a back surge device at 185°C. In order to exacerbate the oxidation reactions, a continuous air flow (100 mL/min) is added to the liquid. Various hydrocarbons are tested as n-dodecane, heptamethylnonane, 1-3 diisopropylbenzene, 2-methylnaphthalene. During a 72 hour test, regular samplings of the liquid and gaseous phases are carried out. They are characterized by GC, GC/MS, HPLC and IR spectroscopy.

As expected, the stability towards oxidation is different from one hydrocarbon to another. For example, more than 50% of n-dodecane reacts during the test whereas the quantity of 2-methylnaphthalene does not change significantly. In some cases, gases like H_2, CO_2 and light hydrocarbons are detected. Nevertheless, oxidized products such as alcohols, ketones and carboxylic acids are formed from all the hydrocarbons. Moreover, this study points out which hydrocarbons could lead to the formation of gums and solids since heavier products than the parent hydrocarbon are observed.