

*IASH 2007, the 10th International Conference on
Stability, Handling and Use of Liquid Fuels
Tucson, Arizona
October 7-11, 2007*

POSTER

**HYDROCARBON LIQUID FUELS THERMAL STABILITY, ANTIOXYDANT
INFLUENCE AND BEHAVIOUR**

Stérenn Gernigon¹, Adrien Aubourg¹, Mickaël Sicard*¹, Frédéric Ser¹, François Bozon-Verduraz².

¹: ONERA, Fundamental and Applied Energetics Department (DEFA). Chemin de la Hunière
91761 Palaiseau Cedex, France

²: Denis Diderot University, Interfaces, Treatments, Organization and Dynamics of Systems
(ITODYS). 2, place Jussieu, 75251 Paris Cedex 05, France

*: corresponding author: mickael.sicard@onera.fr

Jet fuel undergoes oxidative chemistry upon being heated in the fuel systems of advanced civil aircraft. The degradation process may lead to the formation of bulk and surface solids in the fuel system. Deposits formation has different origins; one of them is the dissolved oxygen which initiates formation of peroxides. The aim of this study is to strongly decrease or inhibit the oxidation reactions present during the fuel degradation. This is why the use of antioxidant additives is considered.

In order to study these reactions, oxidation is exacerbated by the use of a back surge device. Liquid fuel is stressed to a bulk temperature of 185°C with an air flow of 100 mL/min. Kerosene is a complex blend of hydrocarbons, approximately 300 species, so we used one of its major components, the n-dodecane n-C₁₂H₂₆, as model. The characterization of the various products (gas and liquid) formed during degradation allows to know the role played by n-dodecane in the degradation of kerosene. Characterization techniques which have been used are GPC, HPLC and IR Spectroscopy.

During a 72 hours test, more than half of the n-dodecane is consumed. This degradation involves the formation of different gases like CO, H₂ and light saturated and unsaturated hydrocarbons. The liquid analysis shows the formation of oxidized products like ketones and alcohols. Moreover, there is no deposit formation. Three antioxidants have been tested on the n-dodecane: the phenol, 2, 6-bis (1, 1-dimethylethyl)-4-methyl- (BHT), the phenol, 2- (1, 1-dimethylethyl)-4-methyl- (TBMP) and the phenol, 2, 4-bis (1, 1-dimethylethyl) (2, 4 DTBP). The quantity added to hydrocarbon is about 1% (wt).

The n-dodecane quantity remains constant with the use of BHT. The latter is consumed in the place of the hydrocarbon according to a linear law. In the first hours, the addition of TBMP or 2, 4 DTBP slightly reduces the rate of n-dodecane degradation. When TBMP and 2, 4 DTBP are completely consumed, the n-dodecane concentration sharply decreases, faster than without antioxidant. BHT is the most performant antioxidant tested because it protects the hydrocarbon from the degradation during 72 hours, whereas TBMP and 2, 4 DTBP protect n-dodecane less efficiently and only during 24 hours.