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Towards an optimal formulation of alternative fuels for aeronautics – Thermal and oxidation stability and polymers compatibility

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Among key challenges for alternative aviation fuels, the oxidation and thermal stability as well as polymers compatibility represent key concerns currently. Oxidation and thermal stability, or the lack of it, can cause jet fuels' properties modification, filters clogging and deposit formation in fuel systems, while polymer compatibility may be responsible of fuel leakage through polymer seals. In this experimental study, PetroOxy and JFTOT tests were used to charachterize the oxidation and thermal stability of alternative jet fuels, respectively, while sorption, liquid permeability, ageing and mechanical tests were employed to test their compatibility with FVMQ, FKM and NBR polymers. Results showed a poor oxidation stability and polymer compatibility of Synthetic Paraffinic Kerosene-Hydrotreated Esters and Fatty Acids (SPK-HEFA). In order to improve these properties, the influence of several cyclic molecules naturally present in conventional jet fuels was investigated, namely, xylene, tetralin and decalin. Sorption tests at ambiant showed a linear incrase of polymers weight with the cyclic molecules content, however, the slope was dependent on both polymer material and cyclic molecule. The addition of xylene increased almost linearly the oxidation stability of HEFA, while tetralin and decalin acted as oxidation inhibitors at low blending rate only. At low content, these molecules allowed to achieve good thermal stability as well. Accordingly, they represent good candidates to improve polymers compatibility as well as oxidation and thermal stability of SPK-HEFA. This work allowed to improve the knowledge on the influence of cyclic molecules on polymers compatibility and oxidation and thermal stability. It paves the way for the design of optimal formulations of upcoming alternative aviation fuels.

Biography

Arij Ben Amara has a Master's thesis in "Energy and Engines" from IFP School and a Mechanical Engineering Diploma from SUPMECA Paris. She is a Research Engineer since 2012 at IFP Energies Nouvelles, a French Public Research Institute. She has published 6 papers in reputed journals and conferences and is author of 3 patents on engines and fuels suitability. Her research activity concerns mainly alternative fuels for aeronautics and automotive applications and fuels stability. She is working as a Teacher at IFP School and Ecole de Mines de Paris.

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