Chemical Model for Autoxidative Degradation of Hydrocarbon Base Fluids

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With advances in modern technology leading to increasing demands being placed on automotive engines, lubricants are having to withstand ever harsher operating conditions and a detailed understanding of the mechanism of degradation is becoming ever increasingly important. One approach is via a detailed monitoring of the oxidation products formed. Although complete chemical analysis of fully formulated lubricants is extremely difficult given the complex nature of such systems, previous studies have identified the base fluid to be the main source of degradation.[1] A great deal of work has been carried out using a variety of model hydrocarbons,[2] and latterly esters,[3] to investigate these processes.

The early reactions in the degradation of these compounds are generally well understood. However, there is much less information on the subsequent reactions of the primary oxidation products, such as carbonyls and hydroperoxides which provide details on the secondary degradation pathways, in part because previous studies have been hampered by unsophisticated analytical protocols.[4]

The present work concentrates on the detailed chemical analysis of the reactions of primary products such as ketones, using a combination of techniques including GC, GC-MS and FTIR. Amongst the model compounds being used is 5-nonanone and a correlation of the physical and chemical properties of the oxidation products is being undertaken to provide a greater understanding of base oil degradation.

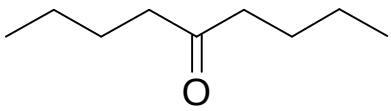

Figure 1: Starting substrate 5-nonanone.

References:

1. Gunsel, S.; Klaus, E. E.; Duda J. L., *Lub. Eng.*, **1988**, *44*, 703
2. Korcek, S.; Jensen, R. K., *Int. J. Chem. Kinetics*, **1994**, *26*, (6), 673 and references therein
3. Lindsay Smith, J. R.; Nagatomi, E.; Waddington, D. J., *J. Chem. Soc., Perkin Trans. 2*, **2000**, 2248
4. Karnojitzky, V.; *Russ. Chem. Rev. (Eng. Transl.)*, **1981**, *50*, (9), 888