Microemulsions as Alternative Fuels

Inaugural - Dissertation

zur
Erlangung des Doktorgrades
der Mathematisch-Naturwissenschaftlichen Fakultät
der Universität zu Köln

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Köln 2008

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Tag der letzten mündlichen Prüfung: 24.10.2008

Abstract

The first patent on "Microemulsions and their use as fuel" [DE10334897A1] was granted in 2003. Microemulsified fuels offer an essential advantage over emulsions because of their themodynamical stability and spontaneous formation. In the present work, water-fuel-microemulsions with extremely high efficiency and strong temperature invariance were developed. These crucial properties were so far unattainable. The physicochemical characteristics of microemulsion fuels could be essentially improved with respect to corrosiveness and acceleration of formation kinetics. Furthermore, using biogenic components, as well as microemulsificating of biogenic fuels such as Biodiesel and BtL (biomass to liquid) brings important contribution to environmental sustainability. Careful consideration and combination of ionic surfactants based on oleic acid and amine base together with nonionic cosurfactants allowed the formulation of highly efficient and temperature-invariant microemulsion systems of the type: water/freezing point-degrading component - fuel - amine base/oleic acid/nonionic cosurfactant. The microstructure of the formulated microemulsions was clarified by means of small angle neutron scattering experiments, transmission-electron microscopy and conductivity measurements.

In an intensive and successful collaboration between research facilities in Cologne, Dresden, Treves and Karlsruhe various investigations on microemulsion fuels were performed. These implied optimization of motor parameters, development of new ideas for injection technologies and exhaust aftertreatment technologies as well as new approaches for pollutant reduction of diesel engines. Detailed investigations of soot formation and composition of particle emissions confirmed, for microemulsion fuels, a reduction of over 90% reduction of soot output concomitant with a NO_x decrease during engine operation. This counteracts diesel dilemma, which is also denoted as soot-NO_x-Trade-Off in the engine development.