Abstract

Water containing microemulsion fuels play a major role in achieving global goals like climate protection and resource conservation. Extensive investigations with water – diesel fuel – microemulsions already proof the benefits of the presence of water during combustion. Using this type of novel fuels, it is possible to significantly reduce harmful emissions like nitrogen oxides and particle matter originating from internal combustion engines simultaneously. This means a breakthrough of the so called soot-NO_x-Trade-Off which is not possible by engine-based measures. In this way, stricter getting emission restrictions can easily be managed and exhaust aftertreatment systems possibly be omitted. Additionally, evaporating water in the cylinder provides volume work, which improves efficiency and reduces fuel consumption in a range up to 5 percent. In this work, several variations of the alcohol type, the alcohol content, the surfactant composition and the water content in suitable microemulsion systems, containing gasoline as oil phase, have been performed to transfer these effects to Otto engines. This led to high efficient systems of the type H_2O/water soluble alcohol – gasoline – fatty acid/monoethanolamine/non-ionic surfactant. First investigations of the combustion of water-gasoline-microemulsions in rig tests rudimentary proof the transferability of the concept to Otto engines, although it became clear that an accurate setting of combustion relevant engine parameters is a challenge dealing with this type of combustion engines. Because of the concept of external ignition, which makes the engine system much more sensitive to changes of all kind, sequences have to be adjusted more properly. In particular, the analysis of the pressure and heating devolution shows a delayed ignition and slower running combustion. Despite that, rig testings without the possibility to adjust the decisive engine parameters partly show significant reductions of pollutants like carbon monoxide, nitrogen oxides and particle number in a few operational states. A slight maximization of the efficiency has also been measured which could be boosted by using methods like higher densification that may be possible due to the higher knock resistance of the water containing fuel.