Experimental investigation of nitrogen based emissions from an ammonia fueled SI-engine

This study concerns nitrogen based emissions from a hydrogen enriched ammonia fueled SI engine. These emissions deserve special attention as their formation may differ from conventional HC combustion due to the nitrogen content in the fuel. A range of experiments are conducted with a single cylinder 0.612 l CFR engine with a compression ratio varying from 7 to 15 using a fuel composition of 80 vol% NH3 and 20 vol% H2. Wet exhaust samples are analysed with an FT-IR. Emission measurements reveal that nitric oxide stem from other reaction paths than the dissociation of molecular nitrogen. This causes the NO emissions to peak around 35% rather than 10% excess air, as is typical in HC fueled SI-engines. However the magnitude of NO emissions are comparable to that of measurements conducted with gasoline due to lower flame temperatures. Nitrogen dioxide levels are higher when comparing with gasoline, but has a relatively low share of the total NOx emissions (3-4%). Nitrous oxide is a product of NH2 reacting with NO 2 and NH reacting with NO. The magnitude is largely affected by ignition timing due to the temperature development during expansion and the amount of excess air, as increased oxygen availability stimulates the formation of the NH2 radical and the levels of NO2 are higher. Under ideal operating conditions (MBT ignition timing) N2O levels are very low. The dominating contributors to unburned ammonia are chamber crevices as the magnitude of these emissions is greatly affected by the compression ratio. However, levels are lower than required in order to eliminate all NOx emissions with a SCR catalyst. © 2013 Elsevier Ltd. All rights reserved.

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