

PRESS RELEASE

## **HCCI-COMBUSTION IN THE Z ENGINE**

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The most common car engine is a 4-cylinder 4-stroke engine. The car manufacturers have a great pressure to lower the cost of the cars and this deals also with the engines. The challenges are the coming new emission norms ( for example EURO-6) and also the custom acceptance, because of the fact, that the car drives are used to a 4-cylinder engine and they want to have the same driving fun also from the new engines.

A 2-cylinder 2-stroke engine has the same power output and torque as a 4-cylinder 4-stroke engine and thus it offers the same driving fun. Equal balancing is easy to make without some big additional costs, if the gas exchange of the engine is made by using poppet valves and camshafts. As there are only about 50% of the moving parts in the engine, its acceleration is even better than by a 4-cylinder engine.

The latest development in 2-stroke engines is the Z engine, having the compression partially transferred outside of the working cylinders. This offers new thermodynamical possibilities to adjust the working cycle and the combustion. As there are methods to control the temperature at TDC, a HCCI-combustion is possible in the Z engine at all loads. This lowers significantly the cost of the engine, as no urea injection, or NOx catalyst is needed to pass the coming EURO-6 emission norm. The cost of the Z engine is lower also because of the fact that it has only 2 working cylinders instead of 4. These unique features lower the production costs of the Z engine about 40% compared to an equal 4-cylinder 4-stroke engine.

The simulations of the Z engine are made with Star CD, GT-Power and Diesel RK. In the HCCI combustion simulation a 4-dimensional ignition delay map, integrated in Diesel RK, has been used. The simulations and tests with the test engine show that the Z engine has a very good efficiency, especially at part load. (See SAE 2009-01-1344, Musu, Gentili, Reitz). A HCCI-combustion at all loads is possible in the Z engine, with lambda about 2 and EGR-rate 15-30%, depending of the load. The TDC-temperature at part load is about 800 K and at full load (bmep 25 bar) about 700 K.

The HCCI- ignition, triggered with an ignition injection, occurs at full load between 15° - 20° ATDC and this limits the pressure and maximal temperature. NOx values are very low as the maximal temperature at full load is about 1800 K, because of the low starting temperature of the combustion and the expansion during the combustion.

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