Effects of high-speed driving on particle number emissions of gasoline cars

Beranek V¹, Sikorová J² and Vojtisek M¹

1 Institute for Automobile, Combustion Engine and Railway Engineering, Czech Technical University in Prague

2 Institute of Experimental Medicine, Academy of Sciences of the Czech Republic

Contacts -> email: vit.beranek@fs.cvut.cz, jitka.stolcpartova@biomed.cas.cz, michal.vojtisek@fs.cvut.cz

What influence does high speed

driving have on Particle Mass

(PM) and Particle Number (PN)

emissions from spark ignition

Six production gasoline cars have

engines?

Conclusions

Both particle number and particle mass emissions were higher during the Artemis motorway (150 km/h) cycle than during the Artemis motorway (130 km/h) cycle, and much higher than during the NEDC. The relatively high PFI engines particle emissions during high speed operation, mostly due to enrichment, suggest that spark ignition engine particle emission problem is not limited to DISI engines but also extends to engines that due to cost saving measures do not use state of the art technical solutions and rely on enrichment.

The DISI engine used in a hybrid featured, among other, advanced variable valve timing, did not use enrichment, and exhibited very low particle emissions during all cycles, suggesting that maintaining low emissions is well within the capability of current gasoline engines.

PM mass No value = test not run PN number (PMP) No value = test not run been subjected to multiple driving cycles chassis CADC motorway 150 on CADC motorway 150 including **dvnamometer** 150 CADC motorway 130 CADC motorway 130 km/h version of Artemis driving **US06** US06 cycle. cycle di euro6 WLTP WLTP ■di euro5 CADC urban + rural CADC urban + rural di euro6 ■ pfi euro5 NEDO NEDC ■ pfi euro5 pfi euro3 1.0E+00 2.0E+12 4.0F+12 4 PN [#/km] PM [mg/km] PM mass No value = test not run PN number (EEPS 5-560nm) No value = test not run CADC motorway 150 di euro6 hybrid was CADC motorway 150 recharging batteries during CADC 150 CADC motorway 130 CADC motorway 130 US06 US06 rush hour, time pressure, WLTP **WLTP** unexperienced ■di euro5 di euro6 HY CADC urban + rural CADC urban + rural drivers or ■pfi euro5 di euro6 wanabe racers NEDC pfi euro3 NEDC ∎ pfi euro5 0 20 40 60 1,0E+10 1,0E+12 1,0E+14 PN [#/km] PM [mg/km] Due to the poor Analyzers on chassis dynamometer test cell engine design some vendors are using enrichment during high engine loads di euro6 HY - 81 kW, odo 1 kkm di euro6 - 92 kW, odo 2 kkm di euro5 - 103 kW, odo 20 kkm speed above pfi euro5 - 63 kW, odo 2 kkm traditional pfi euro5 - 63 kW, odo 30 kkm convention or pfi euro3 - 55 kW, odo 208 kkm limit cycle load • Artemis 150 Artemis 130 160 high speed driving 140 70 demands additional 120 60 engine power 100 km/h power [kW] 50 80 40 Speed, 60 30 20 40 10 20 0 0 0 200 400 600 800 1000 1200 0 100 150 50 speed [km/h] Time, s