

Impact of Ambient Temperature on Particle Emissions from DI Gasoline Vehicle

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In recent year impact of gasoline cars on particulate matter in atmosphere have increased due to wide spreading of diesel particulate filter which efficiency is more than 99%. In addition, emissions during driving in real world such as real driving emission (RDE) have been well discussed. Thus, in this study, we measured particulate emissions from three gasoline vehicles with hybrid technology. As for emissions, addition to gaseous emissions, we measured PN23 which is practically used in certification in Europe and PN10 which is going to be included in certification in Europe near future.

We used an environmental chassis dynamometer which can control ambient temperature from -7 to 35 °C. Tested cars are two direct injection car (GDI-1 and GDI-2) and a multi-point injection car and tested mode was WLTC cold and hot mode without Ex-hi phase because Ex-hi phase is not adopted in Japan.

Emissions results in WLTC cold mode as a function of ambient temperature are shown in fig. 1. CO exhibited negative temperature dependence against the temperature but higher emission was observed at 35°C than room temperature (23 °C). Two GDI cars shows constant NOx emissions against the temperature, but MPI car shows negative temperature coefficient of NOx emissions. PN 23 and PN 10 also showed negative temperature coefficient even at 35°C. Ratio of 10-23 nm particles / PN10 showed positive temperature coefficient.

CO emissions are strongly correlated with appearance of enrichment control. PN emissions exhibited two different natures of emissions. One is similar to CO emissions, correlated with enrichment control another is emission in warming up process. During the enrichment control, emitted particles are mostly over 23 nm suggesting their nature is soot. These temperature dependent features are well observed in WLTC cold mode and negligible in WLTC hot mode.

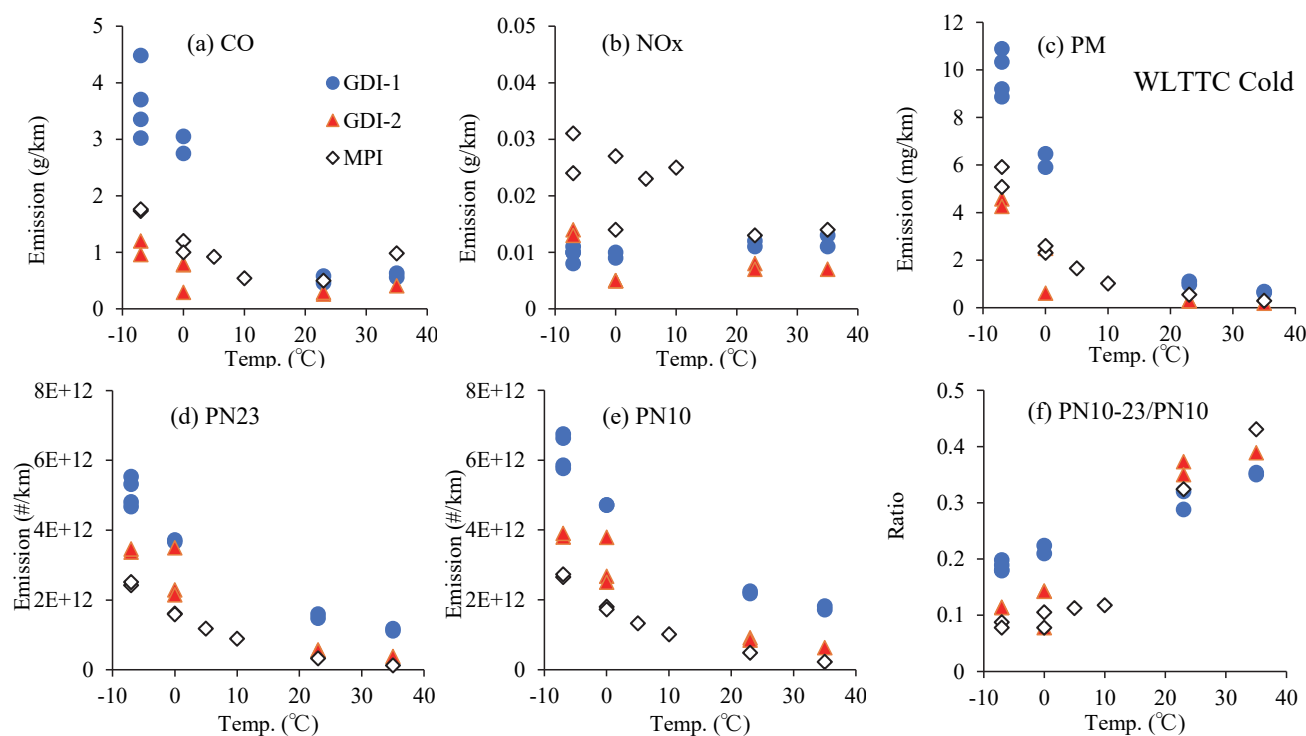


Fig. 1 CO (a), NOx (b), PM (c), PN23 (d), PM (e) and N10-23 / PN10 (f) as a function of ambient temperature with WLTC Cold mode