Experimental investigation of sub-23nm solid particle emissions from diesel, gasoline and CNG engines
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Introduction and project overview

Down To Ten (DTT) project objective: Create a PN-Portable Emission Measurement System (PEMS) demonstrator with high efficiency in determining PN emissions of current and future engine technologies in the real world, including the sub-23 size fraction.

First step: Development of DTT demonstrator for laboratory tests (engine and chassis dyno).

Target: Evaluation of DTT system and investigation of sub-23nm PN emissions.

Sub-23nm Solid Particle Number Emissions – Results

<table>
<thead>
<tr>
<th>Ratio of Solid Particle Number Emissions 10nm/23nm</th>
<th>10nm/23nm ratio</th>
<th>SNP&gt;23 limit</th>
<th>SNP&gt;23 emissions</th>
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<tbody>
<tr>
<td>0.9</td>
<td>1.6</td>
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<tr>
<td>1.3×11</td>
<td>2.4×11</td>
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<td>3.3×12</td>
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<td>5.8×12</td>
<td>7.2×11</td>
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<tr>
<th>Ratio of Solid Particle Number Emissions 2.5nm/23nm</th>
<th>2.5nm/23nm ratio</th>
<th>SNP&gt;23 emissions</th>
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Summary and Conclusions

- High variations are observed among the different fuel types.
- Lower ratios are observed in diesel engines: Close to 1 for SNP>10nm/SNP>23nm and 1.6 for SNP>2.5nm/SNP>23nm. The highest ratio is detected during deSOx event.
- Great variability is detected in GDI engines both in SNP>10nm/SNP>23nm and SNP>2.5nm/SNP>23nm ratios. Higher ratios are observed in transient engine operation (WLTC).
- Much higher ratios were found in CNG engine compared to other fuel types. These can be mainly attributed to lube oil effect.

- Laboratory tests reveal that particles in sub-23nm region should not be neglected, especially when focusing on sub-10nm region.
- As a next step, on-road tests with DTT PN PEMS will be performed in order to draw a clear image about sub-23nm region.
- Possible artefacts especially in sub-10nm region should also be investigated both in laboratory and on-road tests.

PROJECT PARTNERS