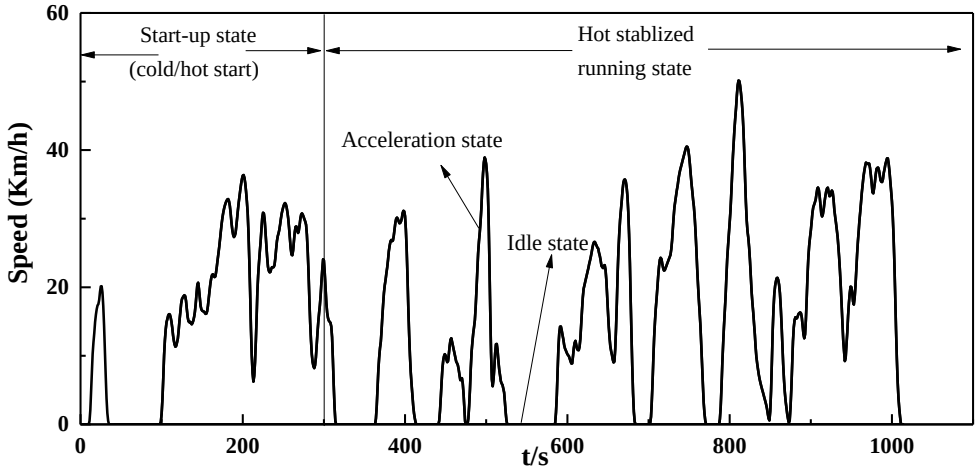
Table S1 Information of various parameters for the vehicles in the experiment

Vehicle ID	GDI-1.4-T
Engine type	GDI
Induction system	turbo
Number of cylinders	4
Displacement/L	1.395
Compression ratio	10.5
After-treatment	TWC
Bore /mm	74.5
Stroke /mm	80.0
Maximum power at engine speed /(kW/(r/min))	110/(5000~6000)
Maximum torque at engine speed /((N·m)/(r/min))	250/(1750~3000)

Table S2 Properties of fuels used in this experiment.

Fuel	F2
RON	93
MON	84
Density（g/cm^3）	0.744
Aromatics（%v/v）	36.7
Olefins（%v/v）	15.4
EtOH（%v/v）	0.01
Oxygen（%m/m）	0.02
MMT（mg/L）	<1
Manganese（mg/kg）	<0.1
Sulphur（mg/kg）	6
T10（℃）	55.4
T50（℃）	109.9
T90（℃）	164.3
FBP（℃）	194.4

(a)



(b)

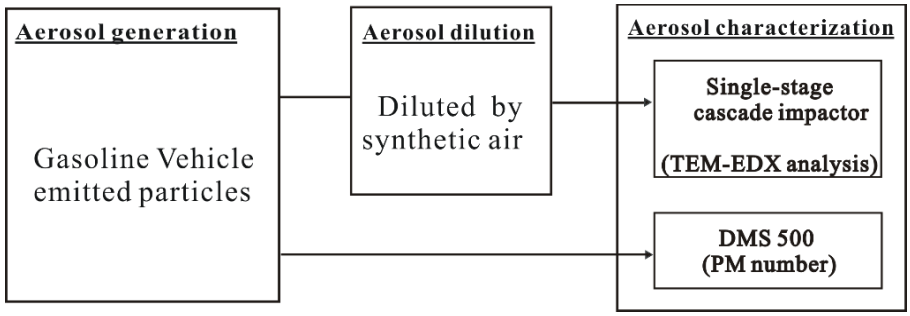


Figure S1. (a) Speed in one Beijing driving cycle under the running test. It is a cycle with a 300-s "cold start" phase followed by a 767-s "hot stabilized running" phase. (b) Sketch of the test system. The number concentration of particles during the tests was monitored by a Combustion Fast Particle Size Spectrometer DMS 500. A single-stage cascade impactor was mounted at the exit of the tailpipe to collect particles on TEM grids with a flow rate 1.0 L/min. A dilution unit was applied to dilute the tailpipe gas into 1/10 concentration using synthetic air.

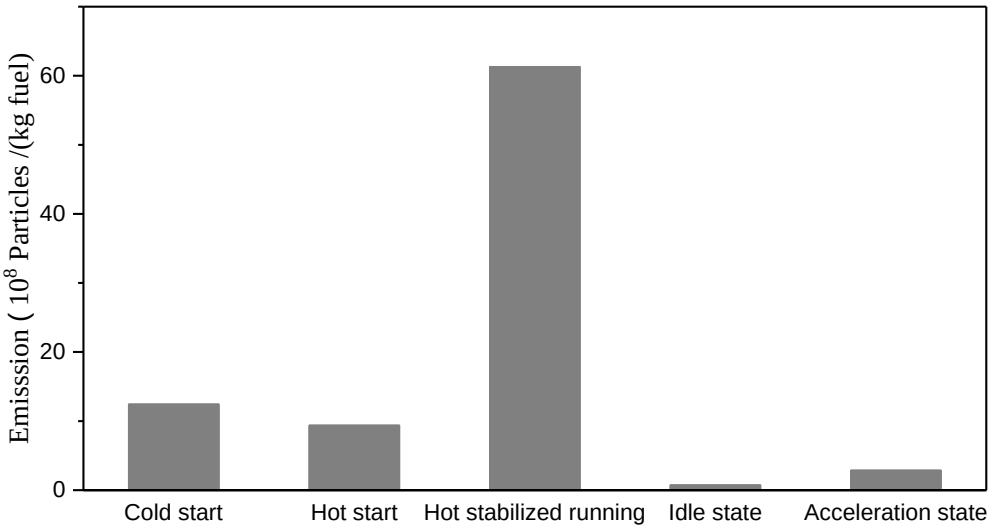


Figure S2. The numbers of accumulation mode particles emitted from the GDI vehicle under different running states.

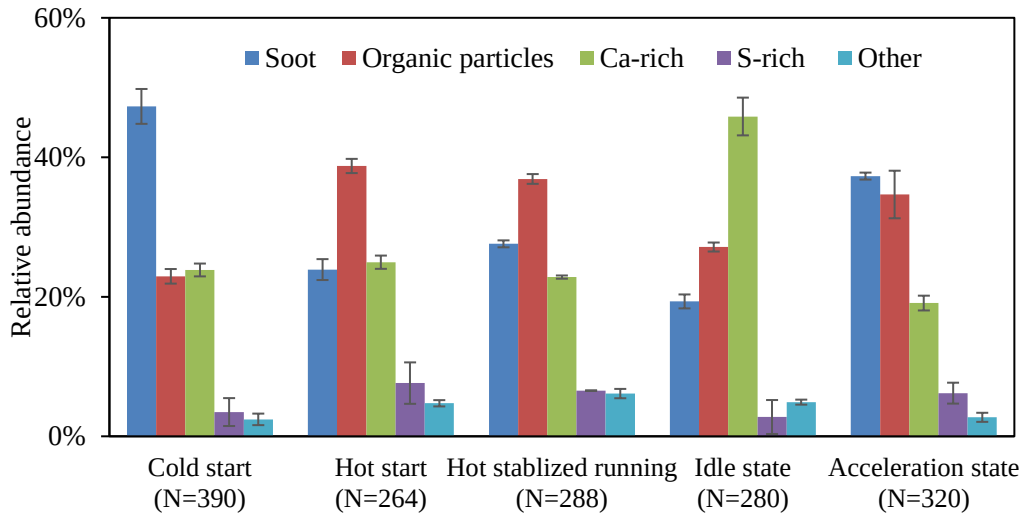


Figure S3. Number fractions of different particle types in the emission of the GDI vehicle under different running states. N is the number of particles analyzed for the different running states. Data presented as mean ± standard deviation, n = 3.