8th November 2018, PMP 48th session

# Development of Tire Dust Emission Measurement for Passenger Vehicle

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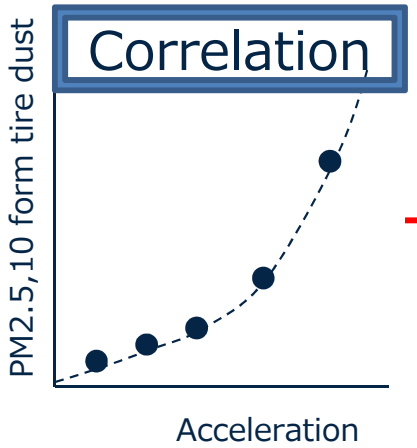
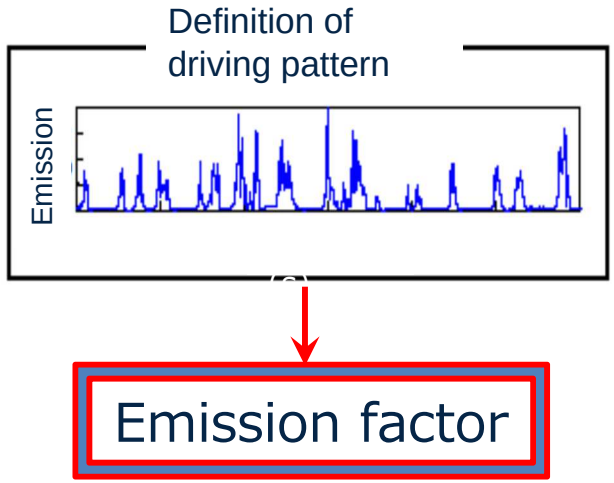
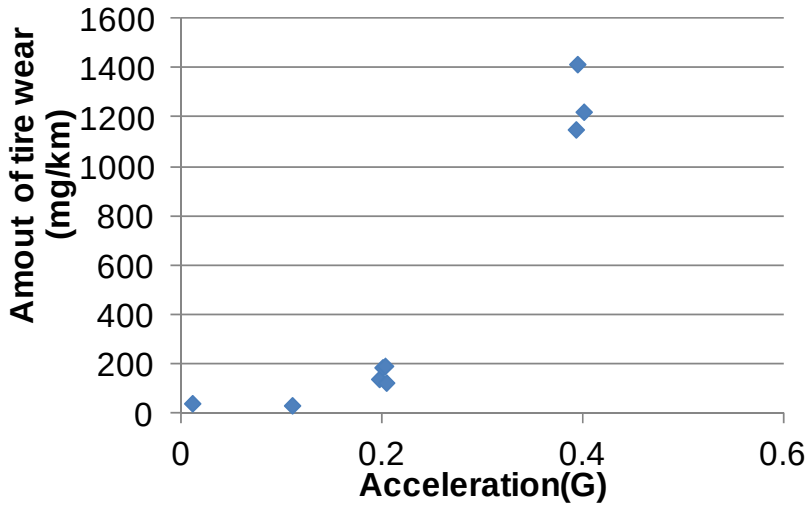
# Topics of this research

- 1. Tire wear particle emission measurement with speciation of tire and road wear on road viehicle test



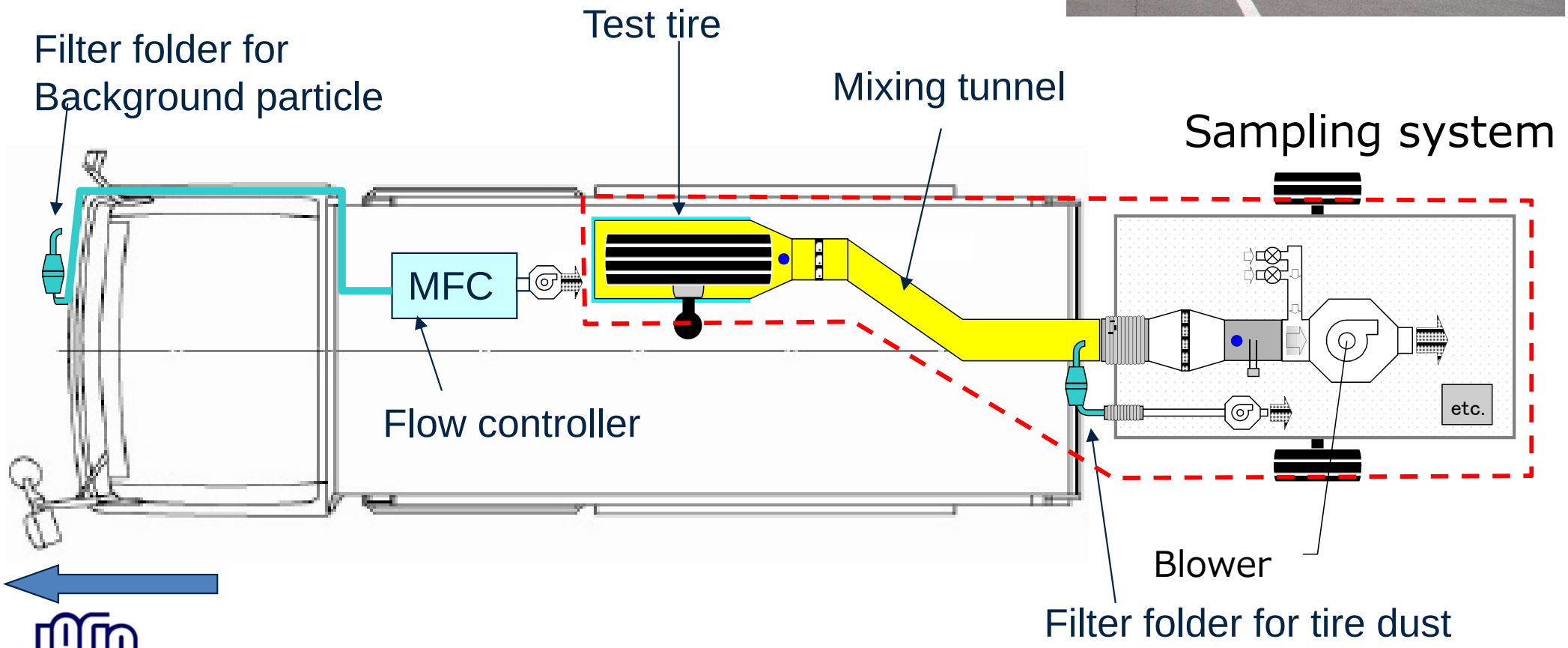




- 2. High sensitive (0.01g/test) measurement of tire wear mass

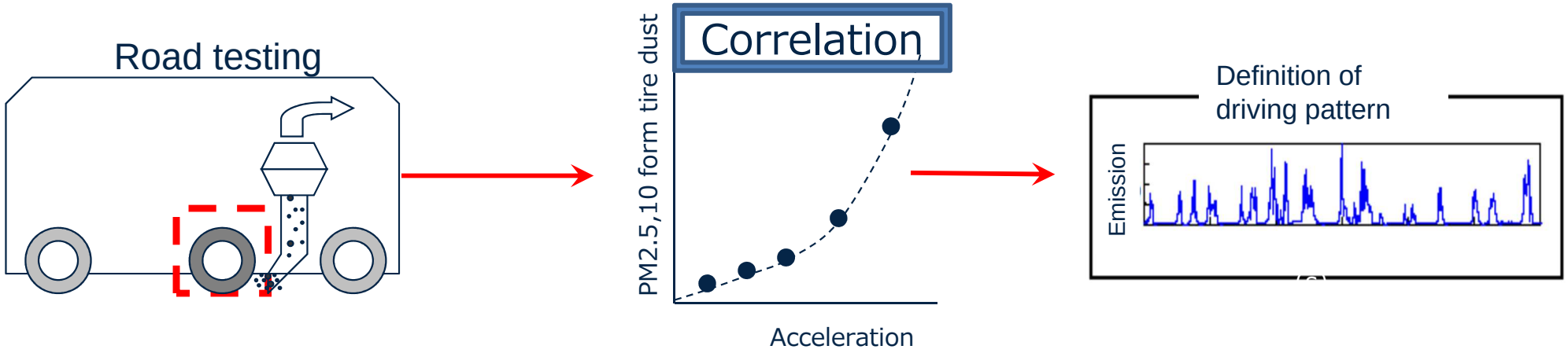



# Introduction of measurement method for tire wear particle at JARI

- Tire testing vehicle with 6-component force measuring system was used for tire dust test. Sampling system similar to CVS system was constructed to collect tire wear particle .



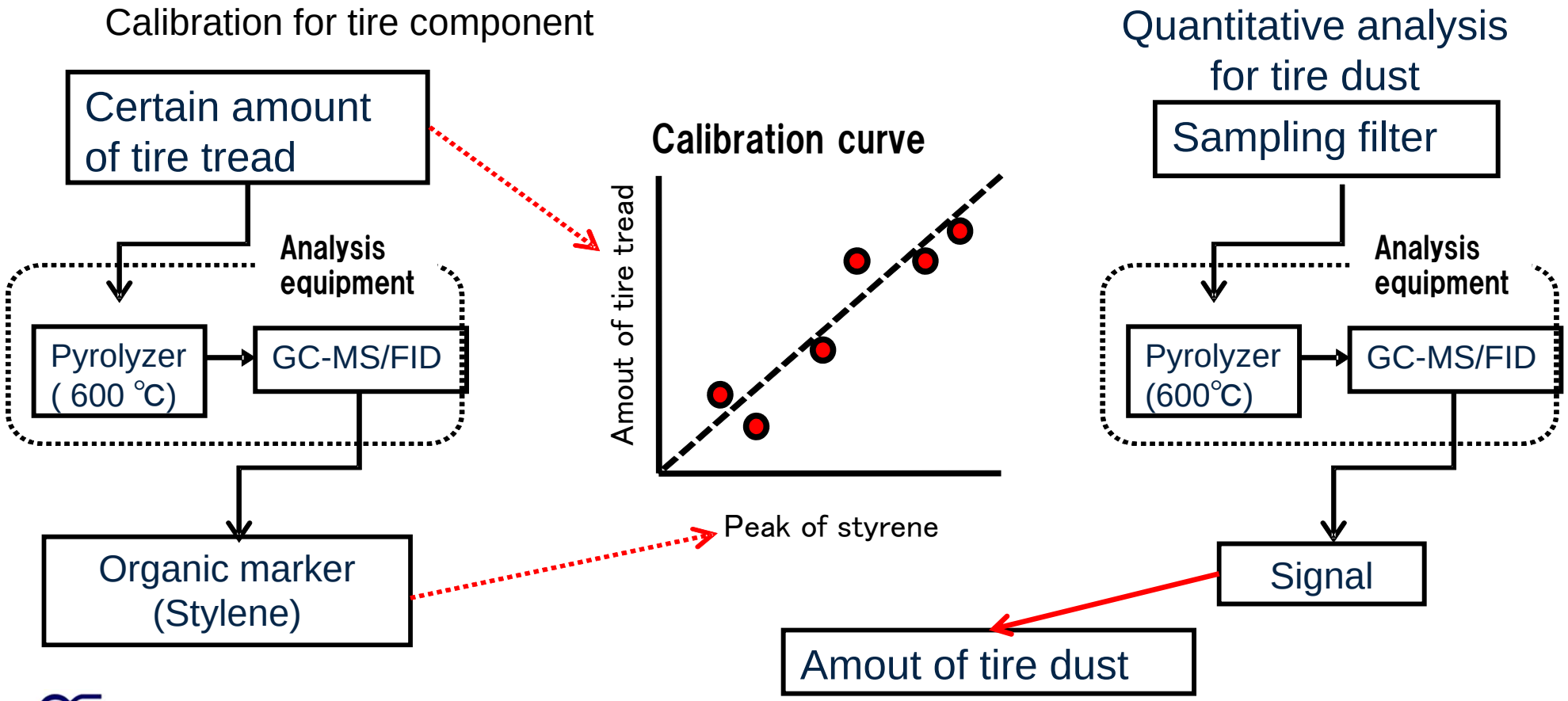
# Estimation of Emission Factor for Tire Dust




- (1)Road testing for tire dust
  - Tire dust collection with constant lateral acceleration.
- (2)Correlation equation for tire dust emission
  - Correlation equation between tire dust emission and acceleration should be built.
- (3)Calculation of emission factor
  - The emission factor is calculated with driving pattern from the result of correlation equation.

# Quantification for tire dust

- Tire dust was quantified by Pyrolyzer-GC-MS/FID.
  - Evaluation for the correlation between amount of tire tread and signal of organic marker (Styrene)
  - Quantification for amount of tire wear by analyzing the styrene signal on the sampling filter

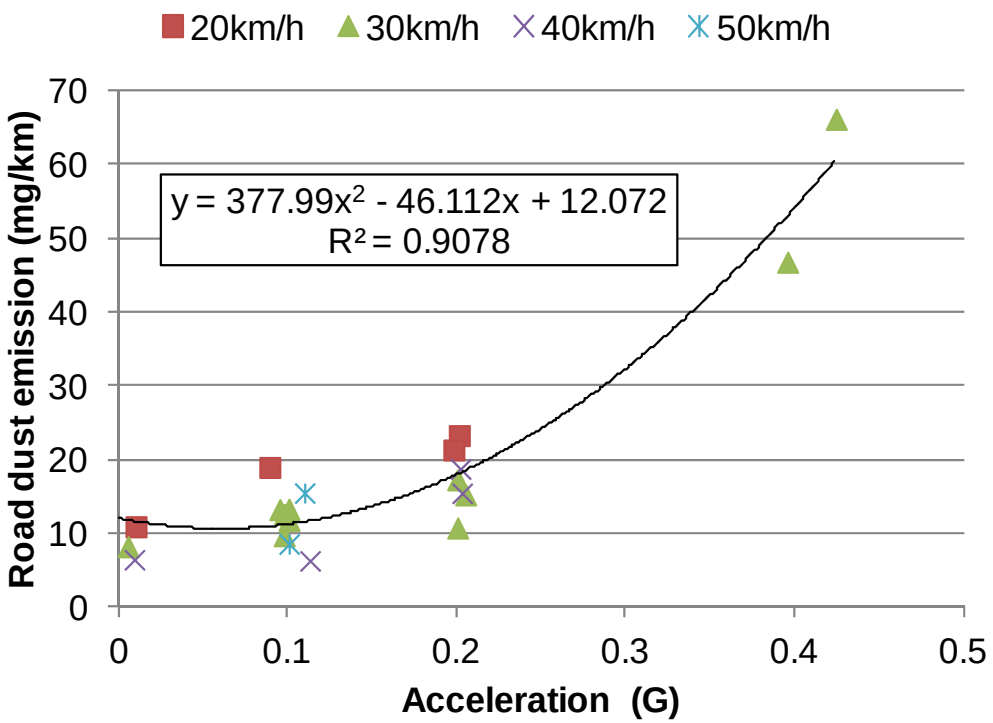



Other method: polymer fragments analysis in ISO/TS 21396:2017

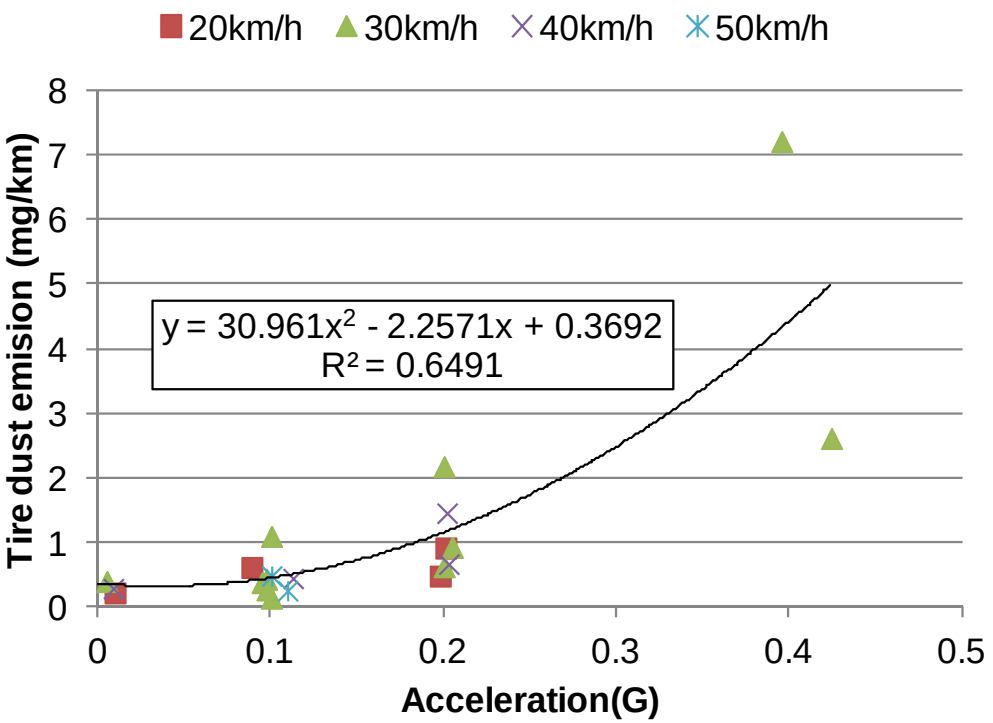
# Test result

- Emission of tire dust was increased with an increase of the lateral acceleation.
- Emission of dust was shown by a quadratic function on acceleration.

## Road dust



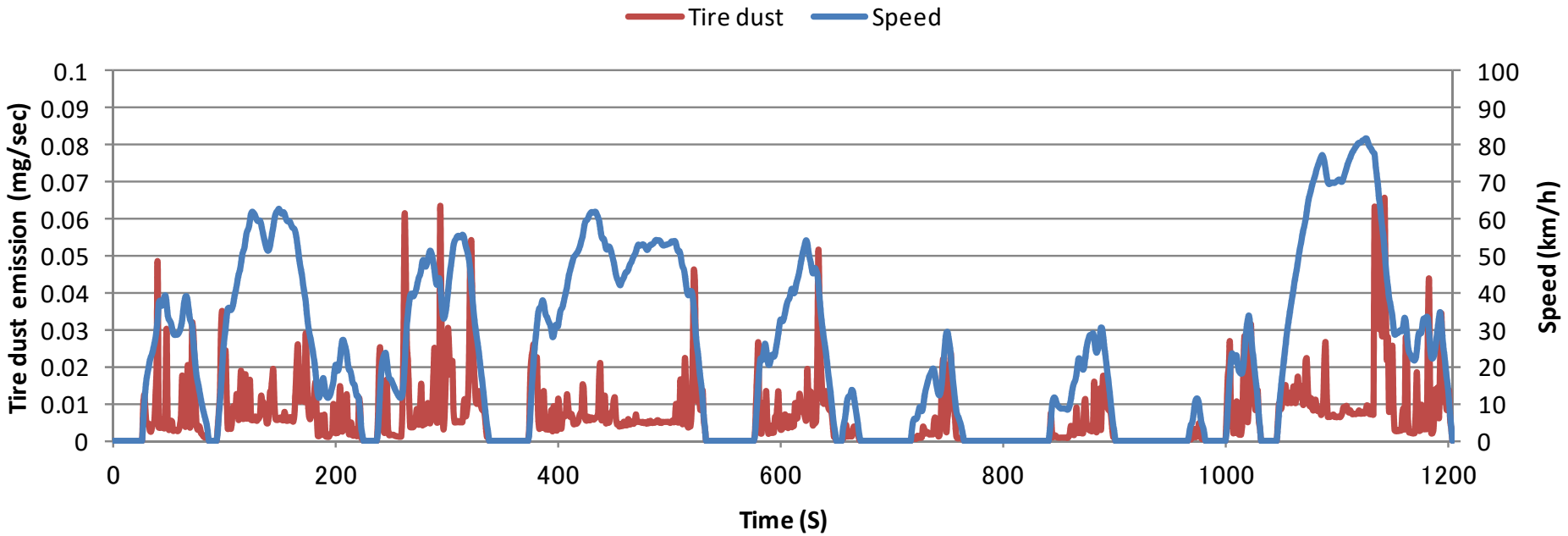

## Tire dust




Test tire: 175/65R17 82S

# Estimation of tire dust emission applied to driving pattern.

- Instantaneous tire dust emission was calculated applied to JC08 test cycle.
- Tire dust should be significantly emitted when acceleration is changed at high speed.
- PM2.5 emission from tire dust was calculated as 3.7 mg/km-vehicle.



# Evaluation method of accurate tire wear mass

- Weighting of tire wear was measured by electric weighting scale(readability: 0.01 g)
  - (Custom made balance for measuring the amount of hydrogen filled in the gas cylinder)
- Tire wear quantity could be evaluate by traveling for several kirometers.

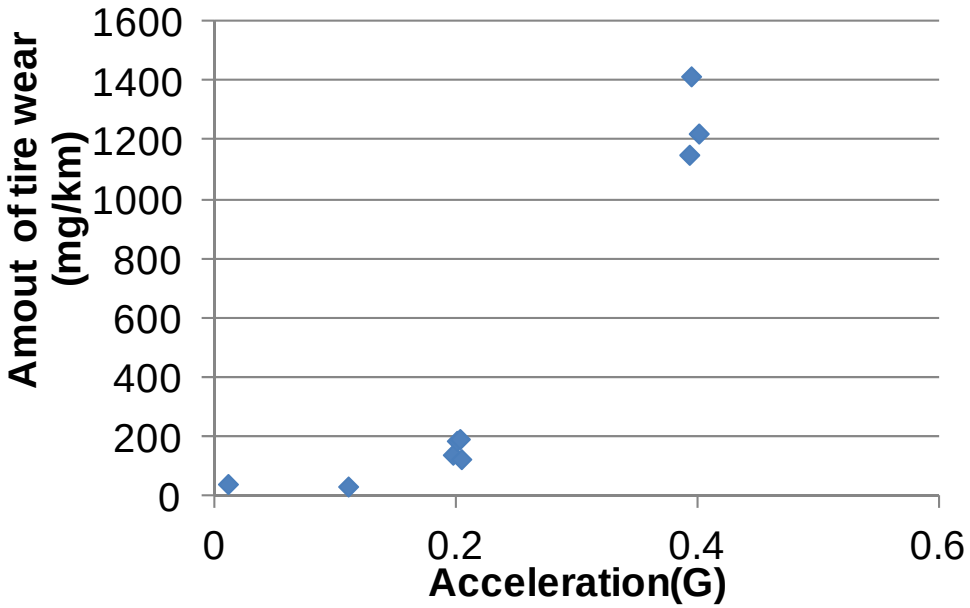
Electric scale for weight of tire assembly


Weighting chamber for tire weighting

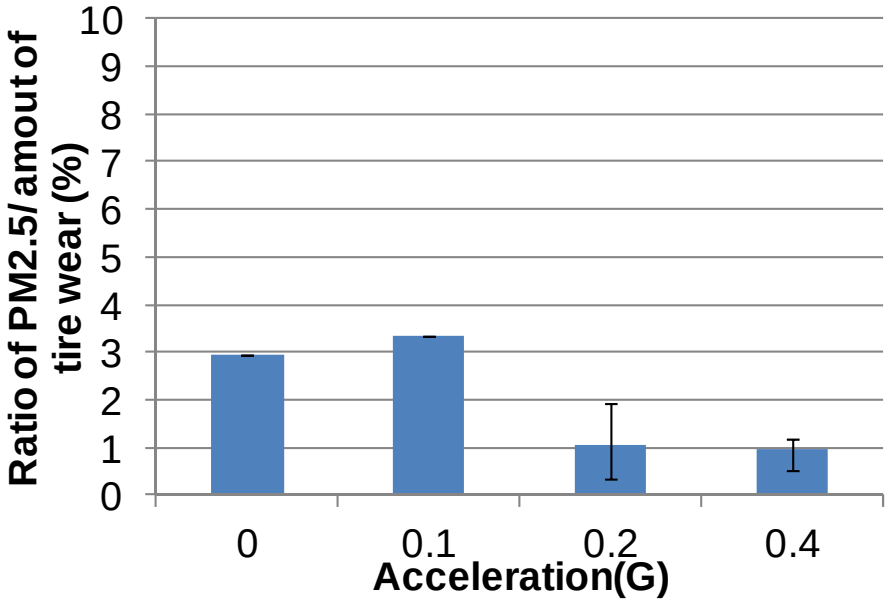
# Experimental result of tire wear and PM2.5 contribution

- Contribution of tire wear particle to atmospheric environment was conformed about 3% (PM2.5) in experimentally evaluation. Therefore, Almost tire dust should be remained on road surface.

Amount of tire wear




PM2.5 contributions of tire wear




Test tire: 175/65R17 82S

# Summary

- 1. Evalution methods for tire wear were investigated.
  - Test vehicle was used to evaluate relationships between lateral acceleration and tire dust emission for emission estimation.
  - Quantitative method for tire dust was developed with thermal decomposition and GC analysis of tire rubber. As a result, it become possible to quantify the tire component in TWRP.

⇒ Emission factor of tire wear particle could be estimated.

- 2. High sensitive measurement of tire wear mass
  - We developed a method that can evaluate the amount of tire wear in a short run by measuring the weight of each tire rim assembly using a precise balance.

⇒ The contribution of airbone tire wear particle was less than 3% to tire wear quantity.