

Implications of Nanoparticle Emissions from Passenger Car Brakes based on the WLTP Brake Cycle

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Brake wear particle emissions are typically associated with vehicle traffic. We determined brake friction works and brake wear particle emissions under realistic vehicle driving and braking conditions using currently used brake systems. We used commercially available brake systems and performed regression analysis between brake friction works and PM₁₀, PM_{2.5}, SPN (Solid Particle Number), TPN (Total Particle Number) [1]. Nanoparticle PM (Particle Mass) emissions tended to increase slightly with lower brake friction works, however, they did not contribute significantly to the overall PM percentage. We found that the phenomenon of emission of high concentrations of nuclei mode particles (<20 nm in diameter) occurred under high temperature and high brake friction work conditions (Figure 1). We found that PN has a different emission behaviour compared to PM, suggesting that the nuclei mode particles are generated from gases emitted by combustion or evaporation of the brake friction materials.

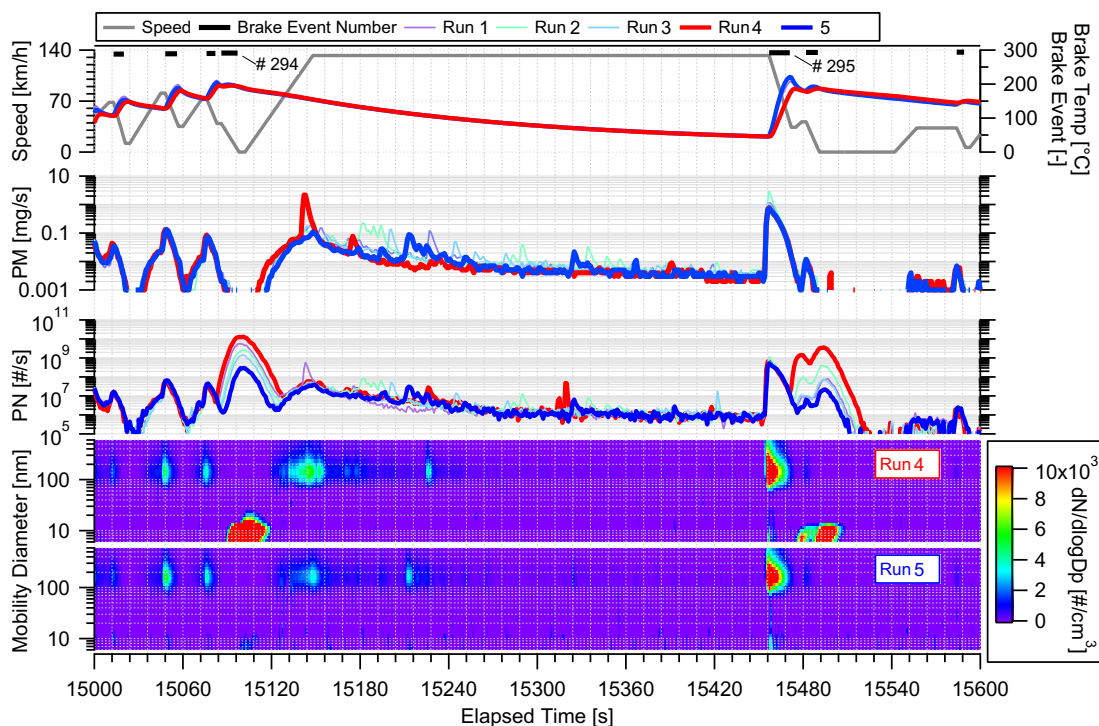


Figure 1 Comparison of speed, brake temperature, PM₁₀, TPN, and distributions of numbers of airborne particle sizes measured in Runs 4 and 5 in FMPS during brake events #294 (15,086 s) and #295 (15,457 s) of the WLTP-Brake Cycle (Data Source : PM data added by author to reference [1]).

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[1] H. Hagino, *Atmosphere*, **2024**, *15*, 75.