

Contributions of Brake/Tire Wear Particles to Non-exhaust Traffic Related PM

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Abstract

Particulate matter (PM) in atmospheric environments affects not only human health but also visibility and climate change. Fine dusts in urban areas are generated from a variety of sources, especially traffic-related sources [1]. Sources of PM emitted from vehicles are classified into exhaust and non-exhaust sources. Exhaust PM can be generated by incomplete fuel combustion and volatilization of the lubricating oil, while non-exhaust PM can be generated by tire dust, brake dust, road wear as well as road dust. In order to meet the recent strict emission regulations, engine combustion and after-treatment technologies have made great progress, and the amount of exhaust PM has decreased, while the relative contributions of non-exhaust PM by tire, brake and road wear to traffic related emissions will increasingly become more significant.

The German Environmental Agency reported that relative contributions of non-exhaust PM to traffic-related emissions would account for 93% of PM₁₀ and 74% of PM_{2.5} by 2030. In addition, the UK Transportation Authority has already reported that in 2015, the contribution of non-exhaust PM is higher than that of exhaust PM. Accordingly, the importance of PM generated by tire and brake wear in non-exhaust PM is increasing, and many studies are being conducted to estimate the physical characteristics of tire/brake wear particles. However, due to the lack of standard measurement procedures, researchers have employed many different sampling methodologies which often result in non-comparable or even contradictory results and conclusions [2].

The Particle Measurement Program (PMP) under the UN ECE (United Nations Economic Commission for Europe) has been working on a voluntary participation-based working group in recognition of the importance and risks of non-exhaust PM. At present, a test cycle named "Noble braking cycle" is made for the brake wear PM, and researches on the accuracy and reproducibility of the measuring equipment and measuring method are on-going. On the other hand, in the case of tire wear particles, the present discussion is temporarily suspended due to technical difficulties that the actual road wear conditions cannot be reproduced in the laboratory.

Tire/brake wear PM are known to be sources of PM₁₀ and PM_{2.5}, so their interest in human health is continuously rising. Therefore, more relevant studies of PM from non-exhaust sources are required to characterize and control their contributions to atmospheric environments.

Keywords: *Particulate matter (PM), Non-exhaust PM, Brake wear PM, Tire wear PM, Atmospheric environment*

References

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Biography

Seokhwan Lee carried out his Ph. D. research at Korea Advanced Institute of Science and Technology. Since 2006, he has been employed in Korea Institute of Machinery and Materials and investigated the contributions of traffic-related PM to atmospheric environments.