Development of Dust Collector to Mitigate the BWPs (Brake Wear Particles) Using the Dispersion Characteristics of Particles

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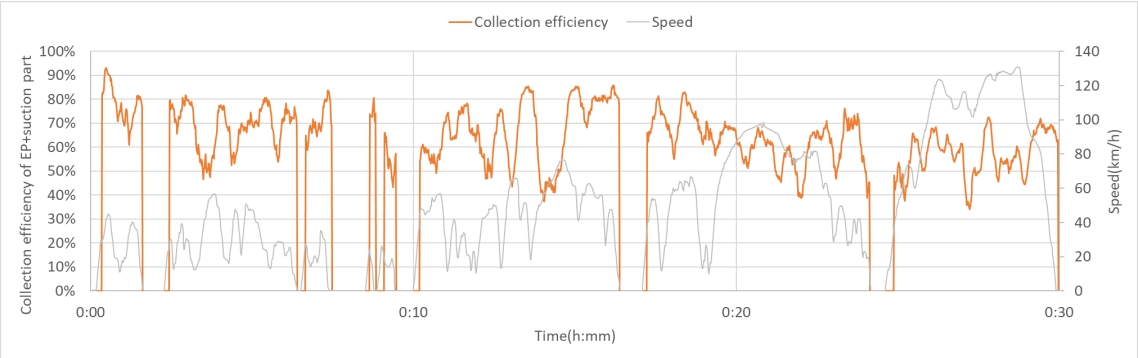
Brake wear particles (BWPs) are one of dominant sources of vehicular non-exhaust PM emissions. The properties of BWP emissions and the BWP emission factor have been extensively researched. This study examined the electrical and dispersion characteristics of BWPs and developed and tested a dust collector to mitigate the BWPs using a brake dynamometer and a chassis dynamometer. Steel fiber, the friction material used in low metallic (LM) brake pads, generated BWPs with a high iron (Fe) content. Conversely, in BWPs emitted from non-asbestos organic (NAO) brake pads, other components, such as zirconium (Zr), potassium hexatitanate ($K_2Ti_6O_{13}$), and others, were identified in addition to Fe. Because the primary component of the braking disk (gray cast iron) was Fe compound, which was similar material of LM pads, relatively little frictional charging occurred in BWPs from LM pads. However, because the brake pad and disk contain different compounds, the BWPs from the NAO pads were strongly charged. Thus, BWPs could be eliminated with an electrostatic precipitator (EP) that doesn't require an additional charging component. EP efficiency of NAO pads was higher than that of LM pads because of the comparatively high charging intensity of BWPs emitted from NAO pads.



Additionally, a suction part was developed to collect BWPs dispersed by the braking system. When the disk rotated at higher speeds, a large amount of the newly created BWPs was re-dispersed and released from the brake system. CFD was used to simulate the route taken by the released BWPs, and an inlet with high suction efficiency was constructed for the suction section. The ability of the BWP dust collector, combined with EP and suction part, to successfully lower the BWP emissions was demonstrated by testing on a chassis dynamometer using an actual vehicle.

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