

Study of Particle Emissions Due to Brake Wear: Impact of Braking Profiles and Transport Efficiency of the Test System

Catapano Francesco; Di Iorio Silvana; Magno Agnese; Vaglieco Bianca Maria

STEMS-CNR, Italy

Abstract

Vehicular emissions represent the main responsible of the deterioration of air quality in the urban area. In the attempt to reduce both gaseous emissions and particulates from internal combustion engines, increasingly stricter regulations were introduced from European Union in the last years. These limits have led to the improvement of emissions-reduction technologies as well as the vehicle hybridization and electrification. In this scenario, vehicle emissions due to other sources rather than the propulsion systems, such as brakes and tires, have taken a significant weight. In this regard, European Commission has proposed the introduction in the next EURO 7 standard of the first-ever limit on the particles emitted by vehicle brakes. This study is devoted to improving the knowledge on the particle characteristics due to the brake wear by means of laboratory experiments thus providing support to the definition of the new standards. An experimental layout was realized consisting in a box where a brake for light duty applications was enclosed. Particles were measured in the size range from 5.6-560 nm and 0.3-10 μm through an EEPS and an OPS, respectively. A section of the standardized cycle for brake emissions and a properly realized profile characterized by intense braking were tested. The impact of the inlet air flow on the measure of the particles was also discussed. The experimental results highlighted the role of braking profiles on the physical characteristics, number and size, of the particle emissions. Low concentration and large diameter particles were emitted under urban driving conditions. On the other hand, hard braking increased the number of particles especially in the small size range.