1.129 Vehicle Emissions and Urban Air Quality: Fundamentals, Trends, and Challenges.

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Abstract:

Automotive fuels and light-duty vehicle technologies have evolved substantially over the past few decades. The fundamental factors influencing this evolution, the likely future trajectory of vehicle emissions, and their impact on urban air quality will be discussed. Emissions of volatile organic compounds (VOCs), CO, nitrogen oxides (NOx), and particulate matter (PM) from internal combustion engines reflect complex processes involving interactions between the fuel and engine parameters. Engine hardware and operating conditions, after-treatment catalysts, and fuel composition all affect the amount and composition of vehicle tailpipe emissions. Fuel volatility and vehicle fuel system design affect evaporative emissions.

Vehicle emissions of VOCs, NOx, CO, and PM contribute to photochemical smog formation in urban atmospheres. There have been large reductions in the emissions from new vehicles over the past several decades. Emissions from the on-road fleet are declining reflecting fleet turn-over as new vehicles with modern emission control systems replace older vehicles. Decreased emissions from traffic have been an important factor in the observed improvements in air quality in U.S. and European cities. As an example, from 1980 to 2014 the national average levels of CO, O_3, Pb, NO_2, and SO_2 in the air in U.S. cities decreased by approximately 85%, 33%, 98%, 57%, and 80%, respectively (USEPA, 2016). The global trend of reduced emissions from road traffic and reduced contribution of vehicle emissions to air quality issues will be presented and discussed.