

Soot Reduction Strategy: A Review

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Abstract: The aim of study is soot reduction strategy by using microwave radiation. As a first step toward the aim is a review. This study provides a review of soot particles generation and their influence on air pollution and illustrates the diesel particulate matter emission regulation, composition, and characterization including size, shape, process, and oxidation. The paper also discusses the effect of temperature, pressure, air/fuel ratio, exhaust flow rate, fuel type on soot process and heat release from soot combustion. The use of filter regeneration strategies for reducing soot emission from vehicles, stationary plants and factories due to the burning of diesel fuel have been presented with advantage and disadvantage of each method. The various strategies include catalyst, fuel injection, electric heating, engine operation condition control, non-thermal plasma, and absorbed microwave energy. The practical feasibility for soot oxidation by microwave heating technique has been explained depending on soot material property. The proposed new technique utilizing the reflected and absorbed energies of microwave for soot reduction strategy is presented to develop a new emission after-treatment system. The new system will be modeled and simulated using appropriate software. The simulation results will be validated experimentally.

Key words: Soot, exhaust after-treatment, microwave technology

INTRODUCTION

Soot is a product of incomplete combustion, produced from vehicles, industrial works, fires and household burning of coal and fuel. The soot particles are a penalty for the entire world where they contribute to climate warming, ice melting (Godfrey *et al.*, 2003) and health hazard (Chen *et al.*, 2009). Figure 1 shows an example of soot exhausting from a diesel vehicle. The U.S. Environmental Protection Agency defines soot or Diesel Particulate Matter (DPM) as the mass collected on a fiber filter from exhaust that has been diluted and cooled to



Fig. 1: Soot Exhaust From diesel vehicle

52°C or below (Stratakis and Stamatelos, 2003). Diesel particulate matter emissions regulations have become more stringent in recent years. The regulation of DPM emission on highway heavy-duty engines sold in the US for the 2007 model year is less than 0.01 g bhp⁻¹ h⁻¹ (Fig. 2) (Henrichsen and Popuri, 2001). To understand soot reduction strategy a review is provided on soot characteristics and formation and effects of operation conditions on soot process.

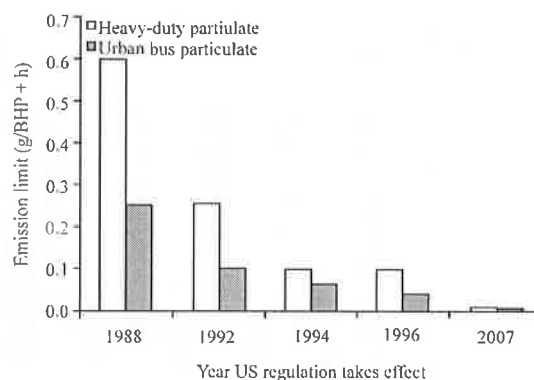


Fig. 2: US particulate emissions standards (Henrichsen and Popuri, 2001)

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