Filter Media Loading Characteristics for Liquid-Coated Particles

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The pressure drop across the filter media as a function of particle loading time is one of the important filter medium loading characteristics. In the past most of the filter loading studies had focused on the filters loaded with either solid or liquid particles. However, particles coated with a variety of liquids are often encountered in the ambient and in industrial working places. Examples of liquid-coated particles are those emitted from diesel/gasoline engines and the crankcases of automobile engines, and those produced during the machining processes e.g., grinding and milling operations (so called metalworking (MWF) fluid aerosol). Hill et al. (2005) suggest that the emission from the crankcase vent may contribute to in-cabin PM. In addition, more PAH species were found in the crankcase emission than in tailpipe emission (Zielinska *et al.*, 2009). Increasing evidence shows that the risk of adverse respiratory health effects increases with increasing MWF aerosol exposure (Kennedy *et al.*, 1989; Greaves *et al.*, 1997, Calvert *et al*., 1998). The filter loading characteristics of such liquid-coated particles could be quite different from those loaded with solid or liquid particles. It is thus needed to characterize the pressure drop evolutions of filters (filter loading behavior) under the challenge of liquid-coated particles.

We have conducted a series of experiments examining the pressure drop evolution curves of filters loaded with liquid-coated particles of different liquid-to-solid-volume percentage. Coated particles formed by solid cores and four liquids, i.e., DEHS, light mineral oil, castor oil, and glycerol as coating material, were produced and four different filter media were tested in the experiments. In general it is found the loading behavior of liquid-coated particles transits from that for the cases of loading with solid-only particles to that for the cases of loading with liquid-only particles as the percentage of liquid

volume in particles increases. It is also found that a small percentage of solid mass in liquid-coated particles could dramatically change the filter loading behavior. However, the transition between two limiting cases (i.e., solid-only and liquid-only cases) is different for different coating liquids on test particles. It is because of their different physicochemical properties. Our experimental data further show that the pressure drop evolution curves of filters are also related to the filter material. The detail of the experimental observation will be presented in this talk.

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