Zinc aerosols from steelmaking EAF: morphology and growth.

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Controlling the emission of zinc from electric arc furnaces poses a challenge, either in terms of compliance or of filter performance. This aerosol occurs significantly within the penetration window of control devices (Flagan and Seinfeld, 1988). This could be compensated through the enhancement of other removal mechanisms, such as the use of adsorbents or the scavenging onto coarse particles coflowing with the Zn-rich fine fraction (Friedlander et al. 1991). The potential improvement—an engineered modification of inlet size distribution at the control device—should be carefully considered (Owens et al., 1996; Linak et al., 1993).

Figure 1 Dynamics of a full-scale furnace (70 t steel/batch) number concentration along 2 batches.

Zinc aerosol formation, speciation and growth is strongly linked to the furnace dynamics (Charging; Melting; O₂ refining and Liquid steel casting) and cooling rate upstream the filter. Precursors are related to volatilization and bursting of CO bubbles inside the furnace. Morphology derivation and evolution of ZnO along a duct under a non-constant cooling rate lead to a high variety of morphologies (porous, nanowires-nanorods, flower-like bundles), Figs 2 and 3 with different surface properties.

This work is the preliminary characterization of the variety and relative abundance of Zn-rich particles arising from a 70t steel/batch furnace, as the first step to control the size distribution of the aerosol along the line (upstream the filter). Theoretical basis to assess the intercoagulation on coarse particles is provided by (Lee and Wu, 2005: Whitby and McMurry, 1997). The experimental method is described elsewhere (Garcia et al, 2006) and uses near real-time aerosol size analyzers, and cascade impactors as size-resolved sample preseparators for further analysis (chemical and morphological).

References