



S1.3.1 - A Novel Measurement Method for Measuring Emissions from Fused Deposition Modeling FDM Printers and Emission Characterizations of Additive Filaments

Jie Zhang¹

¹Virginia Commonwealth University

Three-dimensional (3D) printing technology has been popularizing very fast these years. One of the 3D printers that needs to be particularly focused on is the fused deposition modeling (FDM) printer because it is the most widely used printer in many places such as offices, schools, fashion companies, hospitals and car manufactories to print office supplies, clothes, surgical products and parts. This means that increasingly people will be exposed to the printing process, which will emit a large amount of VOCs and particles. Although many researchers have conducted experiments to measure the characteristics of the VOCs and particles in experimental chambers and on sites, their results have significant inconsistency due to lack of the standard measurement method. In addition, with the increasing market demand of innovative products, manufacturers have been working on new filaments such as adding additives to the pure filaments to feature the printed models with magnetic or texture, visibility in dark, or fluorescence. Although these new filaments have attracted more customers, it increased the exposure risk by complicating the emission processes and generating more particles. However, no literature has shown the

emission characteristics of these new filaments. Therefore, this study is to build a standard measurement method to characterize the emissions of particles and VOCs from FDM 3D printers and explain the aerosol dynamics especially for the particles emitted from filaments with additives. Results show that the VOC concentration and particle size distributions measured by our standard method had a noticeable difference compared to the measurements in previous literature. Filaments with additives in them could emit more than one order of magnitude higher particles than the ones without additives, but the same amount of VOCs. Our results are very useful for the customers to understand the exposure risk and the manufactures to control the emissions of their products.

Jie Zhang

Jie Zhang's study is focused on the characterization of particle emissions from composite filaments during 3D printing and the study of optimal control methods by artificial neural networks.

Keywords:

Fused deposition modeling (FDM) printer

VOC

Particle

Additive filaments