

RAPID + TCT 2019 Conference Abstract Submission

May 21-23rd 2019 Cobo Center, Detroit Michigan

Title: Particle and Chemical Emissions from Additive Manufacturing

Speakers: Dr. Qian Zhang and Dr. Aika Davis

Presentation Topic: Facilities and Operations (safety, workforce development)

Content Type: Expert Overview

Presentation Type: both Traditional (20min + 5 Q&A) and Power-up (10 min)

Audience Experience Level: Novice – less than 2 years of experience

Abstract (215/150-250):

Recent studies show that ultrafine particle and volatile organic compound (VOC) contaminants are released from additive manufacturing technologies during printing, and they may present a health hazard. Ultrafine particles are very small (nano size) and are capable of penetrating deep into the respiratory system. Many VOCs associated with 3D printer emissions are known carcinogens, asthmagens, odorants, and reproductive toxins.

A brief overview of the types and levels of emissions from various 3D printer technologies are presented. We will discuss research of consumer level fused deposition modelling (FDM or FFF) 3D printers, exposure levels and health risks. Experiments employing a standardized emission chamber and data analysis protocol show that 3D printing produces high concentrations of ultrafine particles and numerous VOCs. Particle and VOC emissions depended on the type of filament material, filament brand and extrusion temperature. Particle toxicity was assessed with animal tests, cellular and chemical assays; all 3D printed particles tested showed toxic responses. The talk will conclude with a summary of a standard on testing and assessing 3D printer emissions, ANSI/UL2904.

Significance/Importance (155/150-250):

Exposure levels for particles and VOCs are regulated for industrial settings under occupational regulations such as Occupational Safety and Health Administration, but these are not applicable for office/school/home settings. Emissions from 3D printers are unique and newly introduced to these non-occupational environments. Regardless of the environments, exposure to particle and VOC emissions from 3D printers may result in adverse health responses, especially to sensitive population like children, the elderly, asthmatics, and immunocompromised individuals.

The talk will educate users on the emissions from additive manufacturing technologies and for some predicted exposure levels in different environment. New findings on toxicity of the emitted 3D printer particles as well as chemicals of concern will be discussed. Most importantly, suggested use and methods to reduce emission exposure will be presented. ANSI standard, UL 2904 will be presented; the standard was developed for certification program to promote lower emitting 3D printers and feedstock. Users can choose to purchase certified 3D printers to reduce emission exposure.

Upon completion participants will be able to

1. Understand exposure hazards that they may have not been aware of
2. Operate 3D printers in a way to minimize exposure to particles and VOCs
3. a brief overview of what ANSI/UL 2904 covers