Yumeng Zhao earned her BS in Grain Science and Technology from Henan University of Technology, China in 2014, and MS degree in Agricultural and Biological Engineering from Purdue University in 2016. After MS, she started the PhD program on the dust explosion prevention at Purdue University from 2016. Her research area includes grain milling, particle and particulate system characterization, aerosol modeling, dust explosion prevention.

Agricultural & Biological ENGINEERING

Dissertation Defense

Speaker: Yumeng Zhao

Title: Dust dispersion pattern in confined spaces

Major Professor(s): Kingsly Ambrose

Date: Thursday, July 16, 2020

Time: 10 am EDT

Location or link to join: WebEx meeting

Abstract:

In the grain handling and processing industry, dust emission and accumulation are a major concern for the safety of workers and for explosion risks. Dust emission and accumulation locations highly depend on the facility design and equipment used for handling and processing. To prevent an explosive atmosphere, monitoring the amount of dust accumulated or dispersed is extremely important.
This dissertation simulated one-time and continuous dust dispersion in a confined space using unsteady CFD-DPM model with particle-wall interaction, to mimic dust dispersion from primary explosion and the dust emission from processing equipment. The dust dispersion and deposition pattern were obtained both from simulation and experiments. The relationship between suspended dust concentration and light extinction coefficient was also measured using a two-target method, which can be applied to develop a dust safety monitoring system.

Application:

Due to the uncertainty of environmental conditions and material properties, and with the complexities in the facility design, using a computational method to predict the dust cloud condition will be valuable. Furthermore, mathematical prediction can give more detailed information such as particle movement, dust suspension and deposition patterns. The measurement and characterization of the spread of dust cloud during particulate material processing are essential to predicting dust cloud generation and explosion risk levels, and provide guidance on appropriate dust collection systems design, aiming for preventing dust explosion.