

## NONEQUILIBRIUM FLOWS & FUTURE OF PHARMACEUTICAL MANUFACTURING

# ABSTRACT

IN THIS TALK WE WILL REVIEW NONEQUILIBRIUM FLOWS ENCOUNTERED IN SEVERAL UNIT PROCESS OPERATIONS TYPICAL FOR BIOPHARMACEUTICAL MANUFACTURING. WE WILL CONSIDER THE MICRODROPLET CONDENSATION AND TRANSPORT ENCOUNTERED IN RAPID-DEPRESSURIZATION FREEZING PROCESS AS WELL AS RAREFIED TRANSPORT THROUGH MICROPOROUS MEDIA AND THERMAL INTERACTION CHARACTERISTIC OF DRYING OPERATIONS SUCH AS SPRAY (FREEZE) DRYING AND LYOPHILIZATION, THAT ARE COMMONLY USED TO MANUFACTURING DRUG SUBSTANCE AND DRUG PRODUCTS, ESPECIALLY FOR THERMALLY LABILE LARGE-MOLECULE THERAPEUTICS AND VACCINES. THE REQUIREMENTS FOR MOLECULAR MODELS SUITABLE FOR DESCRIBING GAS FLOWS OF WATER VAPOR AND COMMON NON-AQUEOUS SOLVENTS WILL BE DISCUSSED. WE WILL ALSO DISCUSS WHY FUNDAMENTAL CONSIDERATIONS OF PHYSICAL MECHANISMS INVOLVED IN KEY PHARMACEUTICAL MANUFACTURING OPERATIONS POINT TO THE BENEFITS OF IN-SPACE STORAGE AND MANUFACTURING OF FUTURE LIVE-SAVING MEDICINES.



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# BIOGRAPHY

ALINA ALEXEENKO IS A PROFESSOR AT THE SCHOOL OF AERONAUTICS AND ASTRONAUTICS AND DAVIDSON SCHOOL OF CHEMICAL ENGINEERING AT PURDUE UNIVERSITY, WEST LAFAYETTE. SHE ALSO CURRENTLY SERVES AT PURDUE'S COLLEGE OF ENGINEERING AS SENIOR ASSOCIATE DEAN FOR UNDERGRADUATE EDUCATION AND ACADEMIC PROGRAMS IN INDIANAPOLIS. ALEXEENKO IS A FOUNDING CO-DIRECTOR OF ADVANCED LYOPHILIZATION TECHNOLOGY HUB - LYOHUB ESTABLISHED IN 2014 FOCUSED ON ADVANCING THE SCIENCE AND TECHNOLOGY OF PHARMACEUTICAL LYOPHILIZATION. SHE RECEIVED HER PHD IN AEROSPACE ENGINEERING FROM THE PENNSYLVANIA STATE UNIVERSITY IN 2003 AND WAS A WISE POST-DOCTORAL FELLOW AT UNIVERSITY OF SOUTHERN CALIFORNIA FROM 2004 TO 2006. DR. ALEXEENKO IS AN ASSOCIATE FELLOW OF AIAA AND CHAIRED THERMOPHYSICS TECHNICAL COMMITTEE IN 2016-2018. ALEXEENKO'S RESEARCH IS IN RAREFIED GAS DYNAMICS, HEAT AND MASS TRANSFER MODELING IN APPLICATION TO HIGH-ALTITUDE AEROTHERMODYNAMIC, SPACECRAFT TECHNOLOGIES AND PHARMACEUTICAL MANUFACTURING. SHE HAS AUTHORED 200+ PAPERS AND IS A CO-INVENTOR ON 7 PATENTS. DR. ALEXEENKO HAS BEEN COLLABORATING BROADLY WITH INDUSTRY ON DESIGN AND IMPROVEMENT OF PHARMACEUTICAL LYOPHILIZATION SINCE 2008 AND THE DEVELOPMENT OF NIST-SPONSORED LYOPHILIZATION TECHNOLOGY ROADMAP TO 2025 AND BEYOND AS WELL AS THE FIRST RECOGNIZED CONSENSUS TECHNICAL STANDARD FOR PHARMACEUTICAL LYOPHILIZATION ISSUED BY ASTM IN 2021.

# SEMINAR INFO

**DATE: OCTOBER 20TH, 2023**

**TIME: 10:30AM-11:45AM**

**LOCATION: COB1 110**