Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Flash NanoPrecipitation (FNP) for bioengineering nanoparticles to enhance the bioavailability JIE FENG, YINGYUE ZHANG, SIMONE MCMANUS, ROBERT PRUD'HOMME, Chemical and Biological Engineering, Princeton University — Nanoparticles for the delivery of therapeutics have been one of the successful areas in biomedical nanotechnology. Nanoparticles improve bioavailability by 1) the higher surface-to-volume ratios, enhancing dissolution rates, and 2) trapping drug molecules in higher energy, amorphous states for a higher solubility. However, conventional direct precipitation to prepare nanoparticles has the issues of low loading and encapsulation efficiency. Here we demonstrate a kinetically controlled and rapid-precipitation process called Flash NanoPrecipitation (FNP), to offer a multi-phase mixing platform for bioengineering nanoparticles. With the designed geometry in the micro-mixer, we can generate nanoparticles with a narrow size distribution, while maintaining high loading and encapsulation efficiency. By controlling the time scales in FNP, we can tune the nanoparticle size and the robustness of the process. Remarkably, the dissolution rates of the nanoparticles are significantly improved compared with crystalline drug powders. Furthermore, we investigate how to recover the drug-loaded nanoparticles from the aqueous dispersions. Regarding the maintenance of the bioavailability, we discuss the advantages and disadvantages of each drying process. These results suggest that FNP offers a versatile and scalable nano-fabrication platform for biomedical engineering.

Jie Feng
Princeton University

Date submitted: 01 Aug 2017 Electronic form version 1.4