

# PTPC2019

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## Single droplet combustion of the flame spray pyrolysis precursor-solvent solutions

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Flame spray pyrolysis (FSP) has been widely used to synthesize nanoparticles. The scale-up of this one-step synthesis technique is able to produce several kilogram nanoparticle per hour, and these synthesized nanoparticles have wide applications including sensor, catalysis, biomaterials, battery, phosphors, and electroceramics. Single droplet combustion experiments have been proved to be very useful in providing fundamental information to FSP. In these experiments droplet micro-explosions were observed during the combustion of the FSP precursor-solvent solutions, which has been verified to promote the production of homogeneous nanoparticles for low volatile nitrate precursors. The high-speed camera recording videos show the continuous explosions of these precursor-solvent droplets. Rainbow refractometry revealed temperature gradient in these precursor-solvent droplets. A theory based on the thermal decomposition of the precursor and subsequent shell formation, heterogeneous vapor nucleation was proposed to explain the droplet micro-explosion. In the near future, we propose to use diffractive imaging with x-ray free-electron lasers to investigate the droplet micro-explosion, especially the crystalline nature of particles during the combustion.

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