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Electric Filed Assisted Ultrasonic Spray for Size Controlled Nanoparticles Generation

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Extended Abstract

It is well know that due to large surface to volume ratio, nanoparticles shows different properties as compared to their bulk counterpart. Hence in the recent advanced nanotechnology nanoparticles are being widely used in biomedical, optical, magnetic and as catalysis. However, previous reports shows that as the nanoparticles properties are dependent on their size hence to control the size of the nanoparticles according to the application is prime important. In the past, many research groups have proposed various methods to synthesis nanoparticles such as precipitation, emulsion-based method, spray-drying and paralysis. However, these methods are complicated and require control many parameters such as concentration of the colloidal suspensions(Bogush et al., 1988), process temperature(Iskandar et al., 2003) etc, to control or achieve the desired nanoparticles size. Hence, there is a need to develop new method to synthesis nanoparticles with controlled size.

Among many techniques, spray technique is well known for its simple and relatively cost-effective processing. However, the major drawback of this technique is they can't generate mono-dispersed particles and has adhesion issues with the substrates due to their high flow rate and pressure. In order to overcome these problems, electrospray technique has been reported by (Taylor, 1964). Herein, when a strong electric field impose to the meniscus of liquid solutions, the meniscus experiences electric stress and electrostatic force elongates the liquid to form a cone-jet. The number of droplets are generated at the end of the cone-jet has strong charge and breaks down in to smaller droplets at the Rayleigh limit. This process has limitation of flow rate and the generated droplet size is strongly dependent on cone-jet mode. Hence, there is a need to overcome these issues to achieve controlled size of nanoparticles.

To address the above stated issues, herein we report the combination of two techniques such as electrospray and ultrasonication as electric field assisted ultra-sonic spray. In this newly developed process atomization of liquid containing nanoparticles is achieved by ultrasonication and the charge is applied by applying high electric field to the spray nozzle. Then further theses droplets gets split by electrospray technique as explained above. In this technique, particle size can be controlled by the applied electric field. By applying the proposed method we achieved controlled size of poly acrylic acid (PAA) dispersed in ethanol. The generated nanoparticles were evaluated by scanning mobility particle sizer(SMPS) and field emission scanning electron microscope(FE-SEM). Hence we proved this new technique to control the nanoparticles size and believe that this technique will be useful to the researchers and industry to generate controlled size nanoparticles.

References

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