Ultrasonically Aided Electrospray Source for Monodisperse, Charged Nanoparticles

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Abstract: A new method of producing nearly monodisperse electrospray using charged capillary standing waves is discussed. This method, based on the Ultrasonically Aided Electrospraying (UAE) technology concept, includes the steps of dispensing a liquid on the top surface of a diaphragm so as to form a liquid film on the surface of the diaphragm, setting the diaphragm into vibration using piezoelectric transducer so as to induce capillary standing waves in the liquid film, applying electric charge to the capillary standing waves so that electrospray is extracted from the crests of the capillary standing waves. Theoretical analysis on the formation of charged particles from charged capillary standing waves at critical stable condition is performed. An experimental system is designed, built, and tested and the performance of this new technology concept is assessed. Experimental results validate the capabilities of the UAE technology concept. The method has several applications including electric space propulsion, nano particulate technologies, nano spray coating and painting techniques, semiconductor fabrication and biomedical processes. Two example applications in electric space propulsion and nano particle spray coating are introduced.