**Polymer processing under high shear flow**

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The vortex fluidic device (VFD) is a thin film microfluidic platform with a diverse number of applications, covering the synthesis of nanomaterials involving ‘bottom up’ and ‘top down’ processing, probing the structure of self-organized systems, and controlling reactivity and selectivity in synthesis.1 We are exploring the applications of the VFD in polymer and biopolymer synthesis and gaining access to composite polymer materials, Figure 1. The VFD has intense micromixing and imparts mechanical energy into the dynamic thin film in the rapidly rotating tube (typically 20 mm OD, 19 cm long, quartz or borosilicate glass), and can operate under continuous flow processing such that scalability is factored into the science at its inception.

Complex high shear fluid flow in the VFD can be harnessed to fabricate BSA-gluteraldehyde porous nano-spheres, for application in drug delivery.2 This will be presented, along with developments in understanding the fluid flow, and the utility of the VFD in preparing polysulfone, polystyrene and other polymers, effective mixing of otherwise incompatible biopolymers, for example gelatin (protein/peptide) and dextran (polysaccharide), controlled coating of graphene oxide with polymers, and more. The VFD has a number of operating parameters which can be readily and systematically explored through its high throughput capability> these parameters include tilt angle of the rotating tube, flow rate, concentrations, and temperature.



Figure 1. Illustration of the vortex fluidic device (VFD) which can operate under confined mode or continuous flow mode, with both imparting mechanical energy into the dynamic thin film (< 500 m) which can be harness for manipulating and preparing polymers, and composites thereof, including graphene oxide and polystyrene, as presented in an SEM image.

1.Britton J., Stubbs K., Weiss G., Raston C., *Chem Eur J*, **2017**, 23, 13270 – 13278.

2. Luo, X., et al. *ACS Appl. Mater. Inter*., 10, 27224-27232.