

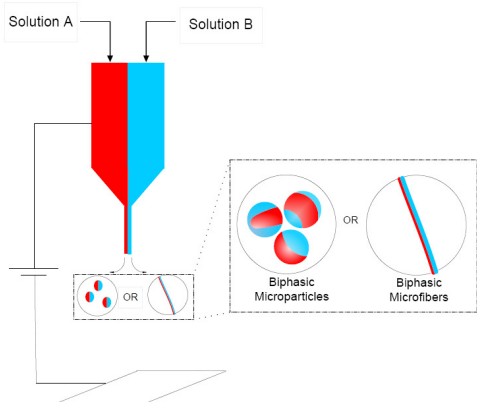
Electrohydrodynamic co-jetting

Background

Particle technologies have been traditionally focused on manipulation of size and shape. Electrohydrodynamic co-jetting, developed in the Lahann Lab, introduces a new design parameter: control over internal architecture. Precise control over distribution of matter, or controlled compartmentalization would be crucial for developing the next generation of 'smart' devices, which would maximize function, utility, and efficacy.

Technology

Electrohydrodynamic co-jetting involves micro-scale fluid manipulation to create polymeric particles and spheres with controllable "anisotropic" or 'compartmentalized structures'. Briefly, two polymeric solutions are pumped through a side-by-side capillary system at a laminar flow rate. Application of a threshold voltage results in the formation of an electrified jet, which results in formation of discrete particles via solvent evaporation. By controlling several process and solution parameters such as flow rate, concentration, viscosity, voltage and conductivity, an astonishing variety of shapes, sizes, and surface structures from different materials can be produced. Three, four, or n-compartmental particles are easily fabricated by simply employing a corresponding number of outlet flows.

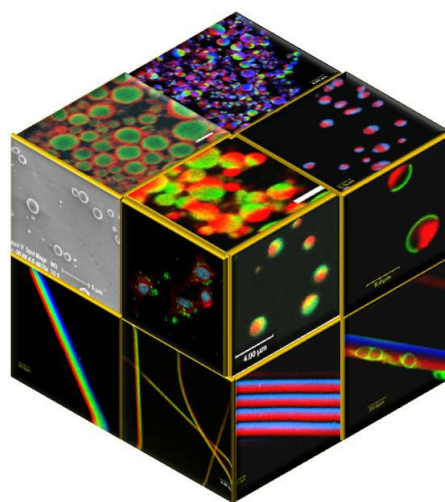


Schematic illustrating electrohydrodynamic co-jetting

Applications

Equipped with precisely engineered compartments and independent surface and bulk chemistries, these particles could be utilized in diverse fields, ranging from drug delivery, tissue engineering, and multiplexed bioassays, to smart displays, colorants and stimuli responsive materials.

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Different nano- and micro-objects (particles and fibers) produced via electrohydrodynamic co-jetting.

Advantages

- Simple and low cost
- Adaptable to a wide range of materials
- Flexibility with respect to shapes of objects produced
- Sizes of objects can be varied over several orders of magnitude.
- Potentially high throughput
- Scalable

Selected Publications

- Roh, K. H.; Martin, D. C.; Lahann, J., *Nat. Mater.* 2005, 4, 759.
- Roh, K. H.; Martin, D. C.; Lahann, J. *J. Am. Chem. Soc.* 2006, 128, 6796
- Roh, K. H.; Yoshida, M.; Lahann, J. *Langmuir* 2007, 23, 5683.
- Yoshida, M.; Roh, K. H.; Lahann, J. *Biomaterials* 2007, 28, 2446.
- Kazemi, A.; Lahann, J. *Small* 2008, 4, 1756.
- Bhaskar, S.; Roh, K. H.; Jiang, X.; Baker, G. L.; Lahann, J. *Macromol. Rapid Commun.* 2008, 29, 1655

Patents

- Lahann, Joerg; Roh, Kyung-Ho. Multiphasic nanocomponents comprising colorants. U.S. Pat. Appl. Publ. (2008), 26pp., Cont.-in-part of U.S. Ser. No. 272,194
- Lahann, Joerg; Martin, David C.; Roh, Kyung-Ho. Multiphasic nanoparticles. U.S. Pat. Appl. Publ. (2006), CAN 145:324630
- Lahann, Joerg. Multiphasic biofunctional nano-components and methods for use thereof. U.S. Pat. Appl. Publ. (2007), 23pp., Cont.-in-part of U.S. Ser. No. 272,194.