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Controlling the dispersion and configuration of nanofillers in electrically driven polymer jets with and without air flow[1] YEVGEN ZHMAYEV, YONG JOO, JAY PARK, LING FEI, PRABHLEEN KAUR, HONGSHEN LIU, Cornell University — Controlling the dispersion of nanofillers in polymer matrices has a significant effect on their properties. Employing circumferentially uniform air flow through the sheath layer of the concentric coaxial nozzle, the gas-assisted electrospinning utilizes both high electric field and controlled air flow which can offer i) enhanced stretching of fluid jet and thus much higher throughput and thinner fibers, and ii) better control of dispersion and configuration of nanofillers in a polymer matrix even at high loadings. The ability to tailor the distribution of various nanofillers (1.85-12.92 vol. % of spherical SiO_2 and Si nanoparticles and rod/tube–like carbon nanotubes and carbon nanoribbons) in a polyvinyl alcohol (PVA) jet was demonstrated by varying electric potentials in conventional electrospinning and air flow rates in gas-assisted electrospinning. The distribution of nanofillers in nanofibers was measured by transmission electron microscopy (TEM), and analyzed using an image processing software to obtain concentration profiles. By increasing the electric potential in conventional electrospinning from 80 to 125 kV/m, we observed almost a twofold improvement in NP distribution. The further enhancement of nanoparticle dispersion was observed in gas-assisted electrospinning: Our analysis indicated an additional 70 percent improvement with the application of high, but controlled air flow. Lastly, the enhanced performance by the resulting nanofibers with controlled nanofiller dispersion will also be addressed in Li-ion battery anode applications.

[1]Axium battery, AZ Electronic Materials

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