

Batteries, Biofuels, and the Sustainable Energy Landscape

Nitash P. Balsara

Chemical and Biomolecular Engineering Department
and

Environmental Energy Technologies and Materials Sciences Divisions
Lawrence Berkeley National Laboratory,
University of California, Berkeley, CA 94720

Traditional approaches for harnessing energy from fossil fuels may not be sustainable. There is, thus, considerable effort to develop alternative approaches for energy production and storage. These include conversion of solar and wind energy into electrical energy, development of hydrogen fuel cells, artificial photosynthesis to produce fuels directly from sunlight, and biofuels. There are major scientific and technological bottlenecks that must be resolved before these approaches can be scaled up to meet a significant fraction of societal needs. I will discuss the possibility of using nanostructured block copolymer membranes in two applications related to sustainable energy. We use these membranes to transport lithium ions in polymeric lithium battery electrolytes, and to separate biofuels such as ethanol and butanol from dilute fermentation broths where they are produced. Previous studies of electrolytes showed an inverse correlation between ionic conductivity and shear modulus: increasing conductivity invariably resulted in a decrease in the shear modulus. Similarly, previous studies of alcohol-selective membranes showed an inverse correlation between alcohol separation factor (ratio of alcohol concentration in the exiting stream to that of the incoming stream) and total flux: increasing the separation factor invariably resulted in a decrease in total flux. We show that block copolymer membranes do not suffer from these inverse correlations.