604b Electric Field-Directed Assembly of Inorganic Particles in Composite Thin Films

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When particles are dispersed in an appropriate solvent, an applied electric field can be used to direct particle assembly. The applied field causes dipoles to form on the particles and if the field strength is high enough, the interaction of the dipole with the applied field will induce motion of the particles. Elongated particles rotate and align in the direction of the applied field. Particles will also aggregate into "string-of-pearl" chains that lie in the direction of the applied field. In this presentation, we show that these electrokinetic phenomena can be used to align a variety of inorganic particles in composite thin films. The direction of alignment can be in the plane of the film or in the transverse direction across this film, depending on electrode geometry. A variety of particles can be aligned, including crystals that are nanoporous or proton conducting. The alignment is maintained in polymer composites by polymerization or solvent casting under an applied field. The aligned composites have potential application in membranes in which the transport properties are optimized by aligning functional particles.