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### **Thermal and pH Transitions in Polyelectrolyte Complexes and Multilayers**

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When oppositely charged polymers are mixed in water, they form a polyelectrolyte complex. Analogously at a surface, oppositely charged polymers can be assembled to form a polyelectrolyte multilayer. Complexation is entropically driven, as it results in the release of small counter ions and water molecules into the surrounding media. First, the effect of time and temperature on the formation of polyelectrolyte complexes containing model polyelectrolytes poly(diallyldimethyl ammonium chloride) and poly(styrene sulfonate) is presented. We show that complexation is a time-dependent phenomena, which is consistent with complexes existing in a kinetically trapped state, rather than a thermodynamic equilibrium. Upon heating, a glassy-viscous transition that shows features of an LCST is demonstrated. Second, the effect of pH on polyelectrolyte multilayer microtubes is presented. The microtubes are made of poly(allylamine) and poly(acrylic acid), both of which are weak polyelectrolytes. Modulating the pH induces a nanoporous transition that results in nanoporous microtubes. These results, in summary, show that noncovalent interactions are very sensitive to external stimuli such as temperature and pH.