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POLYELECTROLYTE GELS AS ARTIFICIAL MUSCLE SYSTEMS

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During the last three years, electromotility of polyelectrolyte gels in ionic solutions has been aggressively pursued at Toyota and Ibaraki Univ. as potential futuristic chemomechanical engines. We have discovered that the underlying physics is much more complex than what has previously been believed, e.g. we find that bending as a function of time seems to obey a $t^{0.5}$ power law, is inconsistent with the idea of a bending speed and strongly points toward a diffusion mechanism. Kinetic evidence of diffusion was confirmed by experiments on gels grown in the presence of dyes. We have explored the effect of varying poly-ion concentration in the backbone and in the surrounding medium. We have discovered that in some cases, the electromotility cannot be described as simple bending. We have also discovered a rich behaviour in the electrical conductivity of these complex materials. Unfortunately, this is not yet understood. Light scattering experiments are also under way.

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