**Electrogels**

Electrically collapsible hydrogels with enhanced mechanical toughness



A Harvard MRSEC team led by **Clarke**, **Mooney**, **Parker**, **Suo**, and **Vlassak** has developed new hydrogels that are both electrically responsive and mechanically tough. Poly(acrylic acid) hydrogels can be made to be macroporous and therefore capable of rapid volumetric collapse (*top left image sequences*). These electrically responsive hydrogels can be integrated into systems capable of rapid configurational changes using simple and inexpensive electronics (*top right photographs*). However, these electrically responsive hydrogels are not very mechanically tough, limiting their broad applicability. When they are interpenetrated with an ionically cross-linked network such as calcium cross-linked alginate, they become more mechanically tough and stretchable (*bottom left image sequence*). This enhancement in toughness (6-fold increase from 0.1 to 30 mM calcium, *bottom right graph*) only moderately reduces the ability of the gel to be electrically collapsed. These mechanical enhancements may enable electrically responsive hydrogel materials to be used as actuators and artificial muscles.