

# **Characterization of room-temperature ionic liquid solvent-based, free radical copolymerized network gels**

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Cross-linked ionic liquid gels (ILG) were generated via a free radical copolymerization of 2-acrylamido-2-methyl-1-propanesulfonic acid (AMPS) and N,N'-methylenebis(acrylamide) (MBA) using 1-ethyl-3-methylimidazolium ethylsulfate [EMIM][EtSO<sub>4</sub>] as a room temperature ionic liquid (RTIL) solvent medium. The AMPS and MBA solubility window in [EMIM][EtSO<sub>4</sub>] at 65°C was determined using a statistical design of experiments approach considering that potassium persulfate (PPS) was used as a fixed initiator concentration. In-situ attenuated total reflectance-Fourier Transform Infrared (ATR-FTIR) spectroscopy showed complete conversion of carbon-carbon double bonds in approximately 300 minutes, where an overall reaction rate constant of 0.069 min<sup>-1</sup> was determined. Dynamic mechanical analysis and differential scanning calorimetry revealed that the glass transition temperature (T<sub>g</sub>) of the resultant ILG could be varied from approximately -85 to -60°C. Additionally, quasi-static mechanical testing showed an elastic modulus in compression range of 10 to 11,400 kPa. The molecular weight between cross-links and the interaction parameter were found to have ranges of 5.0 x 10<sup>2</sup> to 4.0 x 10<sup>5</sup> and 0.54 to 1.40, respectively. Gravimetric analysis indicated that swelling of the ILG is dependent on the relative humidity of the atmosphere, but was found to be more environmentally stable than traditional collagen based gels. Furthermore, electrical conductivity analysis demonstrated a potential for the ILG as membranes in separations or as actuators.