Stretchable and Highly Conductive PEDOT:PSS-PAAm Composited Hydrogels

Univ. of Yamanashi[1], ○YingJun An[1], Kana Iwashita[1], Hidenori Okuzaki[1]

E-mail: okuzaki@yamanashi.ac.jp

Polymer gels, consisting of a cross-linked network swollen in various solvents, have been paid considerable attentions as a soft and wet material responsible for various environmental stimuli such as temperature, pH, salt concentration, solvent, light, and electric field. On the other hand, Poly(3,4-ethylenedioxythiophene):poly(4-styrenesulfonate) (PEDOT:PSS) has been a widely available conductive polymer, and been extensively studied from in both its academic and technological aspects in recent years. PEDOT:PSS has high electrical conductivity but hard and brittle because of the rigid π-conjugation system. In this study, we proposed novel stretchable and highly conductive polymer (S-CP) gels for the applications to organic electronics with soft and wet gel materials, namely, 'gelectronics'[1,2].

The S-CP gels were prepared by casting an aqueous solution of PEDOT:PSS and polyacrylamide (PAAm) and subsequent immersion in water. The electrical conductivity, mechanical properties, and structure of the S-CP gels were investigated by means of four-point method, tensile measurements, scanning electron microscopy (SEM), and electron probe micro-analysis (EPMA). Fig. 1 shows electrical conductivity and mechanical properties of S-CP gels. Although the electrical conductivity decreased with increasing the PAAm concentrations, where the conductivity was 16 S/cm at 70 wt% of PAAm. On the other hand, Young's modulus and fracture stress of the S-CP gel significantly increased at 10 wt% of PAAm, indicating that the PAAm behaves as a filler. It should be noted that the S-CP gels show excellent stretchability where fracture strain reached over 100% at 70 wt% of PAAm.

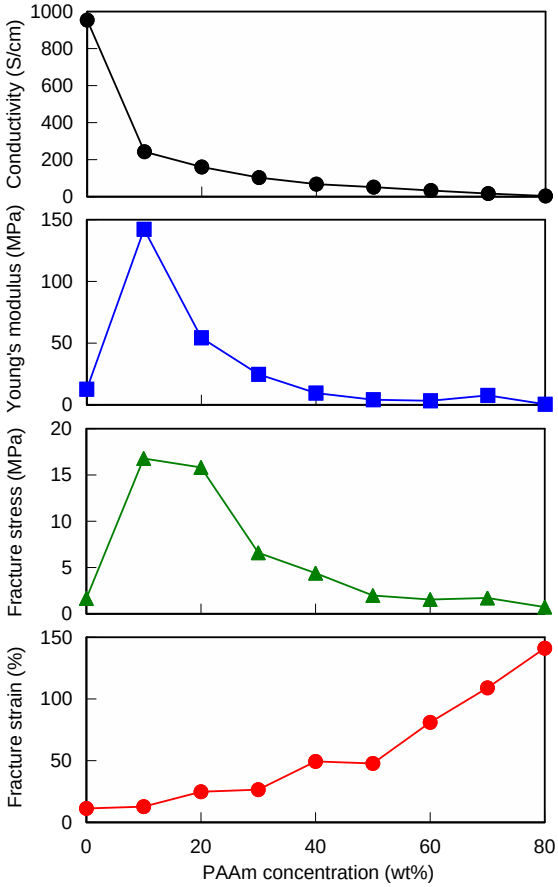

Fig.1 Dependence of electrical conductivity and mechanical properties of S-CP gels on PAAm concentration.

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