

Preparation of tough hybrid hydrogels using water-soluble cyclotetrasiloxane and POSS containing polymerizable side-chain groups as cross-linkers

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Abstract

Hydrogels are biofriendly because they are solid materials that can contain abundant water inside them. Therefore, they are used as soft contact lenses and water-absorbing materials for disposable diapers. However, hydrogels are usually fragile. Therefore, the preparation of tough hydrogels is important for their applications. At the beginning of this century, some tough hydrogels have been developed, *e.g.*, slide-ring gel,¹⁾ nanocomposite gel,²⁾ double-network gel,³⁾ and tetra-PEG gel.⁴⁾

On the other hand, we recently found that a single-structured (*cis-trans-cis*) cationic (ammonium-group-containing) cyclotetrasiloxane (**Am-CyTS**)⁵⁾ and POSS (**Am-POSS**)⁶⁾ were successfully prepared by the hydrolytic condensation of 3-aminopropyldiethoxymethylsilane and 3-aminopropyltrimethoxysilane, respectively, using aqueous trifluoromethanesulfonic acid (HOTf) as a catalyst.

In this study, we prepared polymerizable-group-containing cyclotetrasiloxane (**CyTS-MNa**) and POSS (**POSS-MNa**) from **Am-CyTS** and **Am-POSS**, respectively. In addition, we investigated the preparation of tough polyacrylamide (PAAm) hybrid hydrogels using **CyTS-MNa** and **POSS-MNa** as cross-linkers, and evaluated the mechanical properties of the resulting hybrid hydrogels.

First, **CyTS-MNa** and **POSS-MNa** were prepared by the reaction of **Am-CyTS** and **Am-POSS** with maleic anhydride, followed by neutralization with NaOH methanol solution. Then, the PAAm hybrid hydrogels were prepared by free radical polymerization of acrylamide and the resulting cross-linkers (**CyTS-MNa** and **POSS-MNa**) in degassed water under Ar atmosphere. These hybrid hydrogels indicated flexible nature and were not destroyed in the strain of more than 97%.

References

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