USING GOLD NANOPARTICLES TO PROBE THE STRUCTURAL CHANGES OF A pH-RESPONSIVE HYDROGEL

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Gold nanoparticles (GNPs) have UV-visible absorption spectra that are highly sensitive to their local environment due to their surface plasmon resonance (SPR). Furthermore, GNPs are able to quench the fluorescence of suitable dyes depending on the GNP-dye separation. Both of these features have led to the use of GNPs as spectroscopic rulers. In this study we sought to use GNPs as spectroscopic probes to investigate the local structural changes associated with the macroscopic pH-triggered swelling / de-swelling transitions of a pH-responsive hydrogel. The hydrogel used in this study comprised covalently inter-linked pH-responsive poly(ethylacrylate-co-methacrylic acid-co-divinyl benzene) microgel particles (MGs). MGs are crosslinked polymer colloids that swell when the pH approaches the pK_a of the constituent polymer. The interlinked MG hydrogels are termed doubly crosslinked microgels (DX MGs) and are a new family of hydrogels. They had polymer volume fractions that strongly decreased as the pH increased due to strong gel swelling (Fig. 1a). UV-visible spectra showed that the wavelength of the SPR absorption for the DX MG/GNP gels was pH-responsive (Fig. 1b). The inclusion of Rhodamine 6G within the DX MG/GNP hydrogels resulted in metal-induced fluorescence quenching which was studied using photoluminescence (PL) spectroscopy. The results of the study showed that the pH-triggered changes of the nanoscale and macroscopic swelling for the DX MGs were similar and imply that affine swelling occurred, which is a new observation. The data suggest that UV-visible or PL spectroscopy could be used to study the swelling of pH-responsive hydrogels containing GNPs remotely[1].

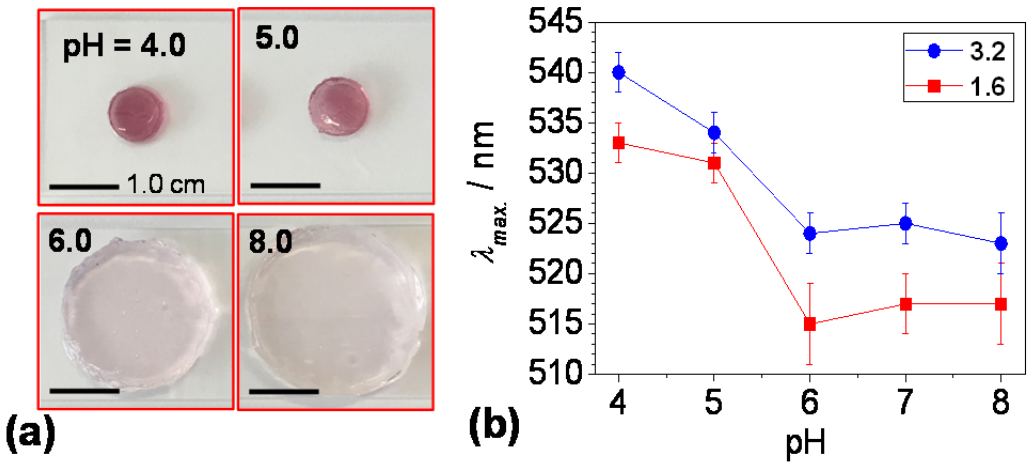

Figure 1. (a) pH-dependent swelling and (b) UV-visible spectra for DX MG/GNP gels.

[1] Saunders et al., *Phys. Chem. Chem. Phys*, 19, 5102, 2017.