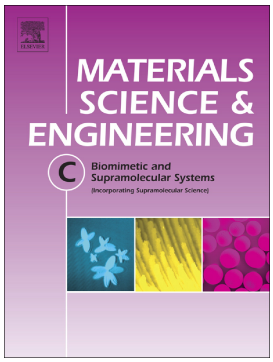

Critical assessment of polymeric nanostructures used as colorimetric ions probes

Katarzyna Kłucińska, Emilia Stelmach, Paulina Bartosińska, Anna Kisiel, Krzysztof Maksymiuk, Agata Michalska

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Critical assessment of polymeric nanostructures used as colorimetric ions probes

Katarzyna Kłucińska, Emilia Stelmach, Paulina Bartosińska, Anna Kisiel,
Krzysztof Maksymiuk and Agata Michalska
Faculty of Chemistry, University of Warsaw, Pasteura 1, 02-093 Warsaw, Poland

Abstract

In this study the effect of nature of nanostructural materials used as colorimetric optical probes on the analytical performance of the resulting sensors is compared.

Different effects related to the nanoprobe materials - probe structure and properties: surface charge and stability, but also effects related to the analyte – receptor interactions – complex formation kinetics and transport of ions from the sample to the probe were taken into account.

Presence of charge on the nanostructural colorimetric sensor effectively hinders ions exchange between the probe and the sample, leading to a linear dependence of absorbance on logarithm of analyte concentration changes. Interestingly, both anionic and cationic micelles are offering linear dependence on logarithm of concentration, covering 2 logarithmic units. Nanostructures, e.g. prepared from amphiphilic polymer Pluronic F127, lead to absorbance dependence on concentration observed in rather narrow concentration range. In this respect crosslinked poly(maleic anhydride-alt-1-octadecene) nanostructures of pH tunable surface charge, due to the presence of carboxyl and amine group on the surface, seem an attractive alternative, offering also the lowest detection limits among tested systems. This system is stable even in the presence of high concentration of background electrolyte in the sample and offers the lowest detection limit, what makes it useful as e.g. indicator for titration.

Generally from the results obtained it follows that inert complexes, hindering ion transport to the probe, can be used to expose a linear dependence of the optical signal on logarithm of concentration, whereas for labile complexes formed sigmoidal type dependences of higher sensitivity over limited concentration range are obtained.

Key words: nanostructural optical probes, surface charge effect, reversibility, sensitivity, colorimetry