

## Grafting of PEG-Macromonomers to Plasma Polymers Using Ceric Ion Initiation

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**INTRODUCTION:** Bioadhesion, the adsorption of proteins, cells, or bacteria to a surface can be extremely detrimental to the performance of medical devices. The consequences can range from fibrous encapsulation of implants to thrombus formation. Prevention of non-specific adsorption is therefore a key characteristic for many biomaterial applications and applying a non-fouling surface treatment can greatly improve the performance and lifespan of some medical devices. Poly (ethylene glycol) [PEG] is currently the most effective chemical modifier at reducing bioadhesion. Plasma polymers provide a thin, conformal, chemically active base on which to graft. It is proposed that grafting PEG onto plasma polymerised surfaces will confer non-fouling properties.

Ceric ion initiation is commonly employed to graft polymers to natural polysaccharides e.g. starch. It is thought that the initiation proceeds through a one-electron oxidation of hydroxyl groups. We have investigated the ceric ion initiated grafting of PEG-macromonomers to plasma polymers with a variety of functional groups including hydroxyl groups. To the best of our knowledge there are no literature reports of ceric initiated grafting from plasma polymers or of ceric initiated grafting of PEG-macromonomers.

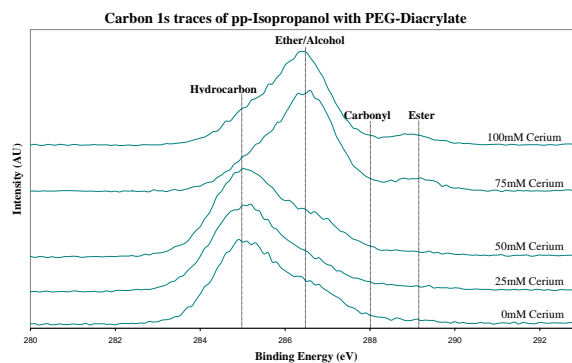
**METHODS:** Radio frequency glow discharge plasma polymerisation of isopropyl alcohol was carried out in a tubular glass reactor to obtain functional surfaces which contain alcohol groups. Substrates used were fluorinated ethylene propylene tape and silicon wafers. Octadiene plasma polymer was used as a control hydrocarbon surface. Characterisation was carried out via X-ray Photoelectron Spectroscopy [XPS] with and without chemical labelling of alcohol groups using trifluoroacetic anhydride.

PEG-dimethacrylate and PEG-diacrylate were dissolved in water and combined with an aqueous solution of cerium prior to the introduction of plasma polymer samples. The influence of reagent concentrations, chemical nature of the plasma

polymer and grafting time were investigated. The samples then analysed by XPS

**RESULTS:** Each monomer produced polymeric coatings that are thoroughly in accord with literature reports.

The success of ceric initiated grafting was demonstrated by the presence of a chemically shifted peak in the C1s narrow scan at 286.5eV binding energy. The intensity of this peak can be directly correlated with the amount of grafted material. In fig. 1 we show the influence of ceric ion concentration on PEG-diacrylate grafting. A higher concentration of ceric ions produces a larger amount of grafted PEG. In the absence of ceric the C1s spectra corresponded with that of the untreated plasma polymer. Polymer graft density is dependant on the plasma polymer chemistry, and concentration of initiator.



*Fig. 1: C1s peaks of pp-isopropanol samples incubated with PEG-diacrylate and cerium ammonium nitrate of varying concentrations.*

**DISCUSSION & CONCLUSIONS:** Ceric ion initiated grafting of PEG-macromonomers onto alcohol terminated plasma polymers is shown to be successful. Grafted PEG should prevent bioadhesion onto surfaces. Work is currently underway to investigate the non-fouling properties of the PEG grafted surfaces using protein adsorption studies.

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