The amination of silicon substract — the first step of grafting of PAA/PAN brush onto silicon

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Introduction

Poly(acrylic acid) (PAA) brushes (either planar or spherical) have aroused great interest in the past decade due to its simple structure, abundant content of carboxyl groups and response to the environment stimulation. Because of its hydrophily, it is often used as copolymer to modify other hydrophobic polymer, such as polyacrylonitrile(PAN). In our experiments, we will graft the PAA/PAN brushes onto silicon substract to characterize its configuration(mushroom or brush, figure 1) with neutron reflection (NR).But first, we should modify the silicon with silane coupling agent-APTES.We used the XPS spectra and contact angle to define the successful grafting of APTES onto silicon.

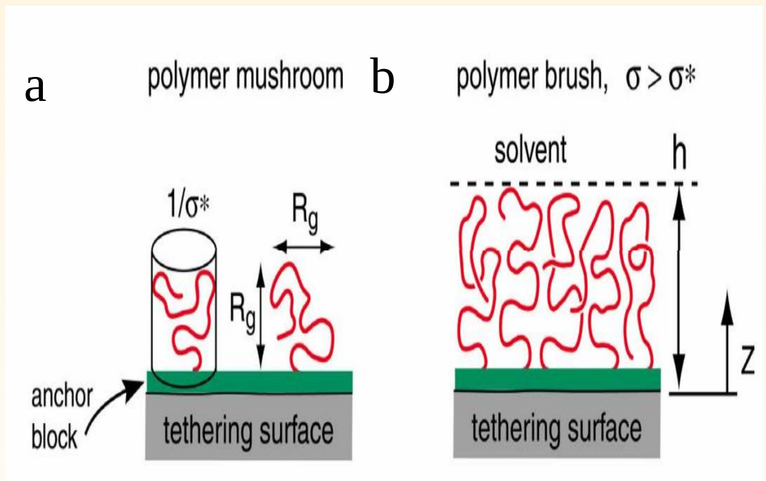

Fig.1 The two configution of polymer brush on the substract: a.mushroom;b.brush

Experiments and data

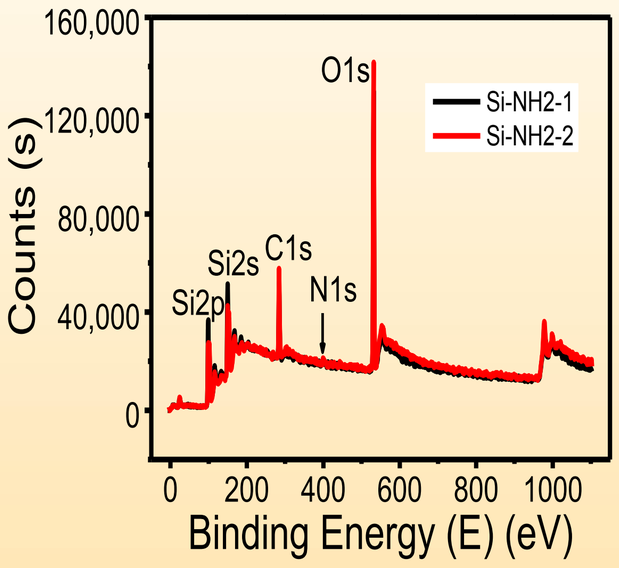

Fig.2 The XPS spectra of silicon modified by APTES

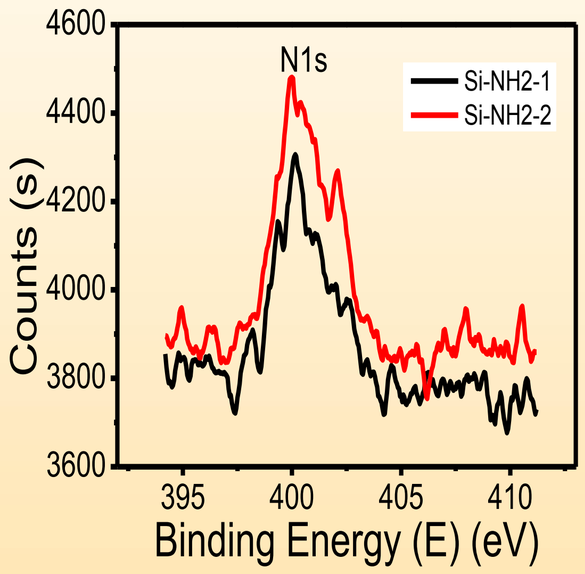

Fig.3 The XPS N1s spetra of silicon-NH2

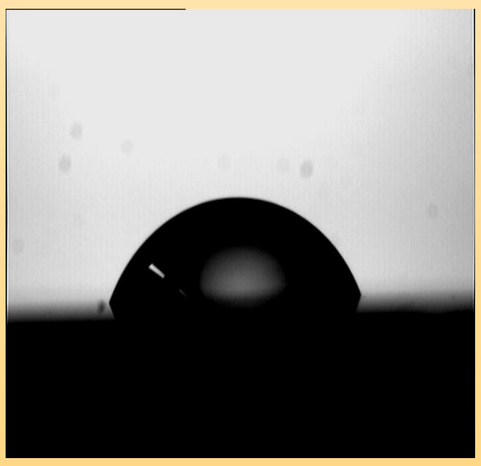

Fig.4 The contact angle of oxidationed silicon substrate

Fig.5 The contact angle of Silicon-NH2

Methods

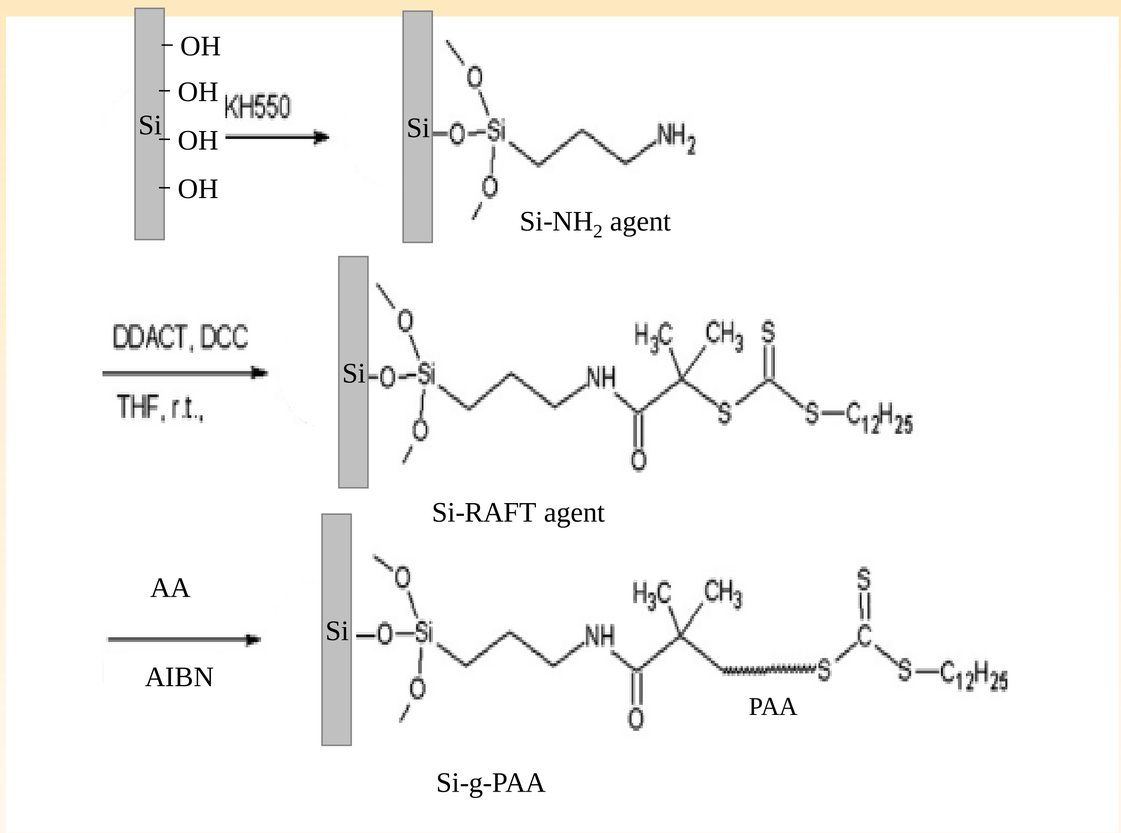

Fig.6 The diagrammatic sketch of the synthesis process of Si-PAA/PAN with RAFT methods.

Discussion and Conclusion

As the figure 6 shows, the synthesis of silicon-PAA/PAN has three processes:(1) the amination of silicon substract, namely the modification of silicon with silane coupling agent KH550; (2) the amidation of NH2 with RAFT agent; (3) the RAFT grafting polymerization of PAA/PAN.

Up to now, we finished the first process.The results is shown in figure 2-5.

X-ray photon spectroscopy (XPS) is a precise and efficient means to analyze surface modifications. The successful modification of silicon substract with APTES(KH550) agent was also confirmed by XPS analysis. It can be seen from figure 2 and figure 3 that the XPS spectra of silicon modified by APTES exhibited a signal of N1s suggested that APTES agent have been successfully.

The contact angle of silicon substract before and after amination was characterized. As can be seen from figure 4 and figure 5, the contact angle of silicon was increased after amination. The reason is that before amination ,the silicon has been oxidized by piranha solution (H_2SO_4:H_2O_2=7:3).There has been a layer of hydroxyl on the silicon, the hydrophily of which is lager than APTES.

In conclusion, the XPS spetra and the contact angle result suggested that the APTES has been grafted onto silicon substract successfully.

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