

キトサングラフトナノ材料によるセシウムイオン吸着メカニズムに関する研究

Study on the Sorption Mechanism of Cesium ion by Chitosan-grafted Nanomaterials

楊樹斌^{1,2}, 張晗³, 王祥科², 永津雅章^{1,3}

Shubin Yang^{1,2}, Cho Han³, Xiangke Wang², Masaaki Nagatsu^{1,3}

静大創造大学院¹, 中国科学院・プラズマ物理研究所², 静大院工³

Graduate School of Science and Technology, Shizuoka Univ.¹,

Institute of Plasma Physics, Chinese Academy of Science, China²,

Graduate School of Engineering, Shizuoka Univ.³

1. Introduction

Radioactive cesium contamination of water is of serious social and environment concern. The cesium radionuclide has a long half-life and is a biological hazard. The sorption and migration of radionuclides are important processes to the transport of radionuclides to the natural environment. So removal of radioactive cesium from the nuclear waste is necessary.

Previous researches proved that ions exchange is the main mechanism of Cs^+ sorption. Exchanged with the cation is the proposed ions exchange mechanisms. In order to detect how important the cation exchange mechanisms are to the Cs^+ sorption, we designed the chitosan-grafted bentonite (CS-g-bentonite) by the plasma-induced grafting method. The interaction of Cs^+ ion with bentonite and CS-g-bentonite composites were investigated by batch adsorption experimental studies. The effects of pH, ionic strength and contact time on Cs sorption process were also investigated to understand the mechanism of the underlying adsorption reactions.

2. Experimental setup and conditions

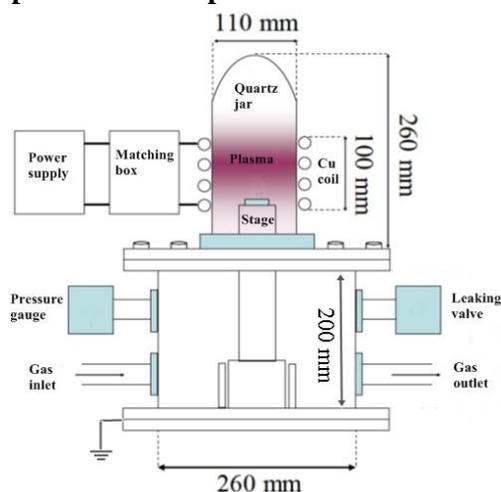


Fig. 1 Schematic view of experimental setup of inductively coupled RF plasma.

In this study, we employed an inductively-coupled radio frequency plasma device. A schematic diagram of the compact experimental setup is shown in Fig. 1. The plasma-induced grafting chitosan on bentonite consisted of two successive processes: surface activation and chitosan grafting. The ICP-RF plasma chamber conditions were: Ar plasma pretreatment at pressure of 50 Pa, and power of 80 W for 10 min.

3. Results and Discussion

The SEM image of CS-g-bentonite (Fig. 2b) shows agglomerate structure with a surface abundant in folds. And the crumpled structures are apparently much more transparent than that of bentonite, which can be attributed to the rearrangement in the morphology of bentonite, suggesting the existence of partial exfoliation of the bentonite layer. The results suggest the formation of CS-g-bentonite structures with some degree of disorder with the possibility of existence of partially intercalated and exfoliated structures. The CS-g-bentonite composites are synthesized successfully.

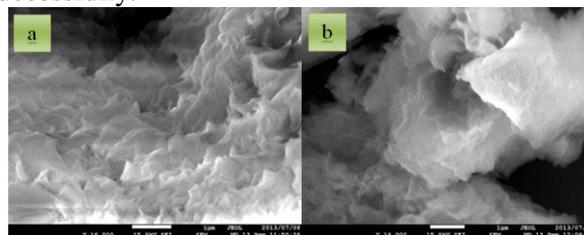


Fig. 2 SEM images of pristine bentonite and CS-g-bentonite

4. Conclusions

This study demonstrates that the sorption of Cs^+ is dominated by strong cation exchange in monovalent Group I and divalent Group II. The spatial structure and cation exchange capacity of the material are very important parts for choosing the sorbent for Cs^+ removal.