ic-mast

7th International Conference on Materials and Applications for Sensors and Transducers
September 24-27, 2018 Bratislava, Slovakia

GLASSY CARBON ELECTRODES MODIFIED WITH ORDERED MESOPOROUS SILICA FOR LEAD DETECTION

Nicoleta Cotolan[1*], Liana M. Mureșan[1], Graziella L. Turdean[1], Andrea Salis[2]

[1]"Babeș-Bolyai" University, Faculty of Chemistry and Chemical Engineering, Arany Janos str.11, RO-400028, Cluj-Napoca, Romania
[2]"Babes-Bolyai" University, Faculty of Physics, M. Kogalniceanu str. 1, RO-400048, Cluj-Napoca, Romania
[2]Università degli Studi di Cagliari, CSGI, and CNBS, Dipartimento di Scienze Chimiche e Geologiche, Cittadella Universitaria SS 554 bivio Sestu, 09042, Monserrato (CA), Italy
** ncotolan@chem.ubbcluj.ro*

INTRODUCTION

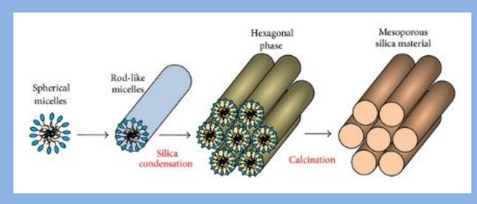
- Ordered mesoporous silica (OMS) from the classes MCM-41 and SBA-15 [1] has attracted the scientists interest due to their large specific surface areas, ordered structure, inert framework, non-toxicity, and hydro/thermal stability, which allow them to be used as catalyst support, as well as adsorption, sensing or drug delivery systems.

AIMS

- The aim of the work was to prepare modified glassy carbon electrodes coated with a composite matrix consisting of four types of original functionalized OMS and an ion-exchange polymer (Nafion) in order to detect Pb (II) ions.
- The role of NH_2- functional groups grafted on the silica surface on the electrochemical behavior of the modified electrodes was also investigated

EXPERIMENTAL

SYNTHESIS OF MESOPOROUS MATERIALS



- The functionalized MCM-41-NH_2 and SBA-15-NH_2 were prepared using APTES through a post-functionalization method.

PREPARATION OF GC MODIFIED ELECTRODE

- The cleaned glassy carbon electrode (GCE) surface was covered with 5 µL OMS suspension (2mg/mL) in SDS 1% and 5 µL of a 2.5 % Nafion solution. The modified electrode was dried 2 h at room temperature.

MORPHO-STRUCTURAL MEASUREMENTS

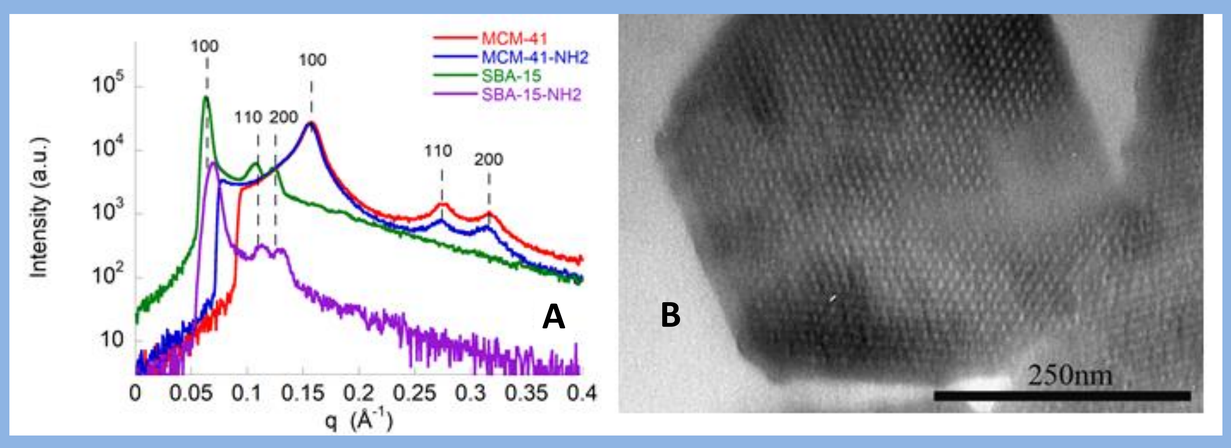


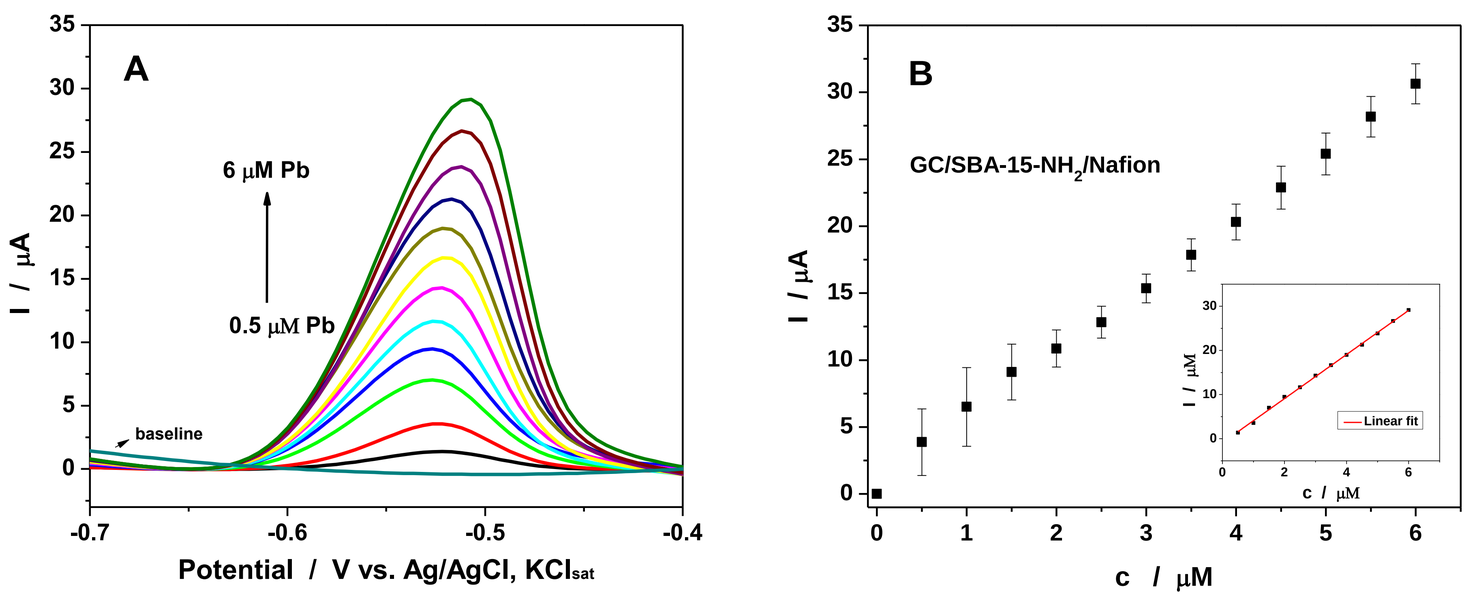
Figure 1. Characterization of MCM-41, MCM-41-NH_2, SBA-15, and SBA-15-NH_2 ordered mesoporous silica samples. A) SAXS patterns and B) TEM image.

Table 1. Characteristics of the various mesoporous silica samples.

Sample	[a]S_{BET} (m^2/g)	[b]$d_{Des,BJH}$ (Å)	[c]$V_{pDes,BJH}$ (cm^3/g)	[d]*a* (Å)
MCM-41	1061	27	1.41	45
MCM-41-NH_2	894	21	0.98	46
SBA-15	880	67	1.25	117
SBA-15-NH_2	373	55	0.65	119

[a] Surface area calculated by the BET method, [b] Pore diameter from desorption branch calculated by BJH method, [c] Pore volume from desorption branch calculated at p/p°=0.99 by BJH method, [d] Lattice parameter obtained by SAXS.

ELECTROANALYTICAL MEASUREMENTS



SWASV recorded at GC/SBA-15-NH_2/Nafion electrode in 0.1 M acetate buffer (pH 4.4) in presence of Pb(II), and in their absence (A); Calibration curve and the corresponding linear fit (B).

Table 2. Electroanalytical parameters of the various GCE modified with mesoporous silica and Nafion.

Electrode	Sensitivity (A/M)	Detection limit (µM)	Linear domain (µM)	R^2/N*
GC/Nafion	1.32 ± 0.063	1.68	0.5-6	0.9927/12
GC/SBA-15/Nafion	3.36 ± 0.038	0.72	0.5-5	0.9993/10
GC/SBA-15-NH_2/Nafion	4.82 ± 0.063	0.24	0.5-6	0.9983/12
GC/MCM-41/Nafion	2.84 ± 0.037	1.19	0.5-6	0.9976/12
GC/MCM-41-NH_2/Nafion	2.41 ± 0.051	1.27	0.5-5	0.9963/10

*Number of points

CONCLUSIONS

- The analytical parameters of the prepared electrodes determined by square wave anodic stripping voltammetry were very promising, recommending the use of the modified electrode for real samples analysis.
- Ordered mesoporous silica immobilized on GCE improve the electroanalytical parameters of GCE/Nafion electrodes due to their large surface area and to their adsorption ability.

Bibliography

[1] El-Salamony R. A., Gobara H. M., Younis S. A., Journal of Water Process Engineering, 2017, 18, 102-112.

Acknowledgements

This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI-UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0652 / 84PCCDI/2018, within PNCDI III.