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In-situ polymerization of aniline covalently bound in the channels of MCM-41

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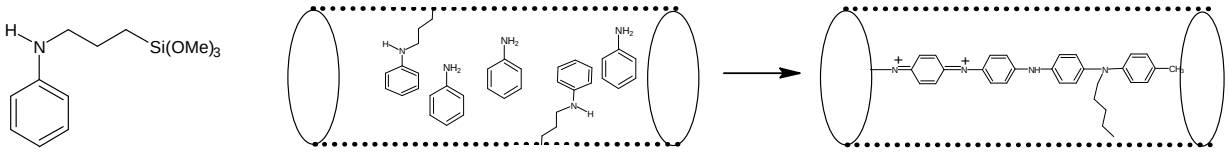
Abstract – In this work we have shown the preparation of MCM-41 functionalized with N-propylaniline, which was further used in situ aniline polymerization using ammonium persulfate as oxidant agent. For comparison proposes, MCM-41 without functionalization was also prepared. The materials were characterized by XRD, FTIR, TG and electrical conductivity. The obtained composites show higher thermal stability.

Usually the preparation of composites of polyaniline and inorganic materials involves impregnation of the monomer into the porous inorganic network followed by oxidation. In the materials obtained by this procedure it is not observed a strong interaction between the polymer and inorganic matrix. Improved properties might be achieved by grafting the polymer into the inorganic mesoporous structure [1]. In this work we carried out the fabrication of covalently bound polyaniline by using N-propylaniline functionalized MCM-41 as a mesoporous support (Scheme 1).



Scheme 1: N-[3-(trimethoxysilil)propyl aniline and in situ polymerization of aniline with the formation of covalently bound emeraldine salt into the MCM-41 channels.

MCM-41 functionalized with N-propylaniline was prepared by refluxing MCM-41 with [3-(trimethoxysilil)propyl aniline in toluene during 24h. Following, functionalized MCM-41 was impregnated with aniline during additional 24h at 40°C under reduced pressure and then polymerized with ammonium persulfate in acid medium.

The XRD patterns of MCM-41, functionalized MCM-41 and the composite PAni/MCM-41 exhibited the same peaks, indicating that all processes do not compromise the framework structure of the parent mesoporous material (Figure 1). The presence of the N-propylaniline functionality in the porous walls of MCM-41 was confirmed by FTIR, which showed characteristic bands of propylaniline and polyaniline. The TG analyses indicate the presence of polyaniline and seem to have more thermal stability than the free polymer.

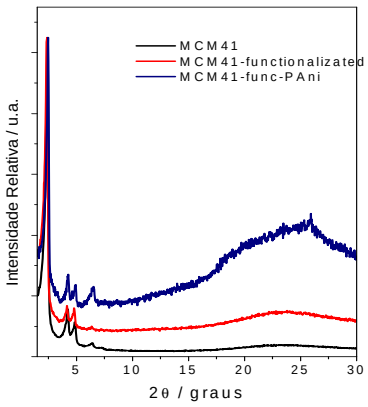


Figure 1: XRD data of MCM-41, funcionalized MCM-41 and MCM-Func-PAni

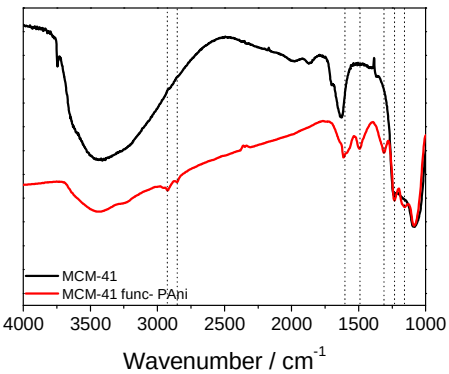


Figure 2: FTIR of MCM-41 and MCM-41 func-PANi

References

[1] M. Sasidharan, N. K. Mal, A. Bhaumik, J. Mater. Chem., 17, (2007), 278.