XIV ENCAT
Encontro de Catálise do Norte, Nordeste e Centro-Oeste
Catálise: Impulsionando a transição energética para um futuro mais sustentável
17-19 novembro 2024 • Fortaleza
SBCAT SOCIEDADE BRASILEIRA DE CATÁLISE

ÁREA: Síntese e caracterização de materiais

Zeolite growth over fiberglass for biogas enrichment

Lucas M. Sousa (PG)[1*], Adonay R. Loiola (PQ)[1]

[1]*Laboratory of Nanostructured Materials, Federal University of Ceara, Fortaleza-CE, 60.440-900, Brazil*

**E-mail: lucasmedrado@alu.ufc.br*

Abstract

Biogas, produced during anaerobic digestion processes of organic substrates from industrial, agricultural and sewage waste, is considered a promising alternative source of renewable energy [1]. It is mainly composed of CH_4 (50–70%), CO_2 (30–50%) and other gases in smaller quantities. The removal of CO_2 is a key stage for biogas to be commercially used. In this context, the adsorption of molecules on solid surfaces combined with the PSA method has been efficient in applications with several selective grade materials, such as membranes, titanosilicates, carbon molecular sieves, and silica gels. Zeolites, which are part of the tectosilicate subgroup, are well-known as efficient CO_2 adsorbents. This work aims to promote the growth of zeolite A on fiberglass by using nanozeolite A as seed to induce the controlled growth of zeolite crystals over the fiber surface giving rise to materials suitable to form cartridges to be used as columns for biogas enrichment. The fiberglass underwent an activation process that consisted of contact with NaOH solution for 72 h, under orbital stirring. Next, the fibers were impregnated were molded as cylinders and impregnated with nanozeolite which were dispersed in water. The seeded fiber was then submitted to zeolite growth by a hydrothermal treatment for 4h in. The gel composition used in the synthesis was 3.165 Na_2O: Al_2O_3 : 1.926 SiO_2 : 128 H_2O.

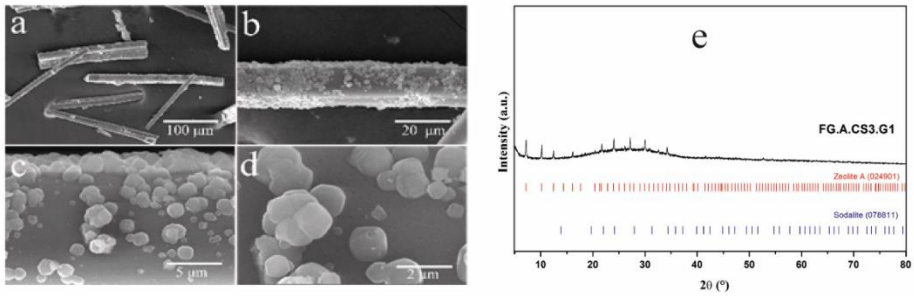

Figure 1. (a-d) SEM images of the zeolite prepared over the fiberglass and (e) XRD patterns of the same sample.

The activation of the fiberglass by alkaline treatment was efficient in favoring the growth of zeolite type A crystals due to the increase of the roughness on the fiber surface, combined with the increase of silanol groups present in its filamentous structure, therefore compatible with the species present in the synthesis gel that give rise to the grown zeolite A. The X-ray diffractogram shows peaks consistent with zeolite A as well as the baseline distortion related to the amorphous nature of the fiberglass [2]. The scanning electron microcopy images allow the visualization of cubic crystals of zeolite A grown on the glass fiber, indicating the effectiveness of the experimental approach and shedding light to a possibly potential material to be applied in the removal of CO_2 in the enrichment process of biogas..

Keywords: biogas, zeolite, fiberglass

References

[1] PAOLINI V. et al. *J Environ Manage* 217 (2018) 288–296
[2] OLIVEIRA E. S. et al. *Quim Nova* 45 (2022) 16–22.

Acknowledgments

CNPq, CAPES, and Laboratory of X-ray (UFC)