Área: MAT
(Inserir a sigla da seção científica para qual o resumo será submetido. Ex: ORG, BEA, CAT)

Functionalized tellurite and fluorotellurite glasses with lanthanide metal-organic frameworks (Ln-MOFs) for optical gas sensing

Renato G. Capelo (PG),[1] Ricardo S. Baltieri (PG),[1] Caroline M. Silva (PG),[2] Guilherme Arroyos (PG),[2] Regina C.M. Frem (PQ),[2] Danilo Manzani (PQ).[1*]

renatocapelo@usp.br; dmanzani@usp.br

[1]Instituto de Química de São Carlos, IQSC-USP; [2]Instituto de Química, IQ - Unesp Araraquara.

Palavras Chave: *Gas sensing, metal-organic frameworks, optical fibers, luminescence.*

Highlights

- The work focuses on the development of optical fibers with a large transmission window for application in remote sensing of toxic, explosives and greenhouse gases and vapors.
- A facile in-situ growth of luminescent metal-organic frameworks (Ln-MOFs) on tellurite and fluorotellurite glasses is presented.
- Ln-MOFs were obtained MOFs with different crystalline structures depending on the glass composition, with different ZnF_2 concentrations.
- The hypersensitive emission of Eu^{3+} at 615-630 nm was monitored and the quenching in the luminescence intensity indicates a great potential for its remote sensing of gases.

Resumo/Abstract

The development of sensors for gases detections has been a hot scientific topic, especially for the control and monitoring of environmental pollutants. However, gas monitoring is hampered in many cases by difficult of access, high risk of on-site detection, or sampling in the case of explosive or toxic materials. In this context, sensors based on optical fibers become a promising alternative for remote sensing, allowing in-situ and faster responses, and excellent detection levels compared to semiconductor or electrochemical sensors. For gas sensing, optical fibers sensors can detect gases in real time and without degrading the samples. Another class of materials that shown great potential of chemical and gas sensing is the luminescent lanthanide MOFs (Ln^{3+}-MOF), especially for nitroaromatic explosive and other volatile organic compounds (VOCs). Thus, this work aims to the development of optical sensors based on optical fibers functionalized with luminescent Ln^{3+}-MOF for remote detection of gases. Initially, the pieces of tellurite glasses, a glass matrix suitable for optical fiber production due to their great thermal stability against crystallization, high refractive index and large transparency window, were functionalized by in-situ growth of Ln^{3+}-MOF. The functionalization with Ln^{3+}-MOFs have been made with Eu(III) MOF $\{[Eu(HPDC)(PDC)]\}_n$ (PDC = 2,6-pyridinedicarboxylate) by solvothermal method at 180 °C for 20 min. The MOFs synthesis is performed with the glass inside the reactor to promote the in-situ growth of MOFs crystals on the surface. The hybrid material obtained has been characterized by FTIR and Raman spectroscopies, X-Ray diffraction, Scanning Electron Microscopy (SEM) and Photoluminescence. The first results indicate the growth of different crystalline structures depending on the tellurite glass composition, with different amounts of fluoride ions. Chemical and VOC sensing trials, such as TNT, nitrobenzene, and chloroform, were carried with glass pieces containing Ln3+ -MOF on their surfaces and exposing the samples to analytes for different duration to evaluate selectivity and sensitivity parameters although Fluorescence Spectroscopy. The hypersensitive emission of Eu^{3+} at 615-630 nm was monitored and quenching in the luminescence intensity was observed for different analytes, which indicates a great potential of application of this MOF for remote sensing of gases, coupling it to optical fibers of tellurite glasses

Agradecimentos/Acknowledgments

The authors acknowledge grants from São Paulo Research Foundation (FAPESP) (Project n°, 2020/12280-1), CNPq and CAPES for the financial support.