TiO2 activated foam glass as reactive environmentally friendly construction material

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Introduction

In the dynamic building industry foam glass is considered a new sustainable environmentally friendly and ecological material. Incorporated in real buildings as construction state of art innovative material resolve the energy lost and most of the demanding conditions found in building industry. Also, self-cleaning materials have gained significant attention for their unique practical applications in environmental areas.

Experimental

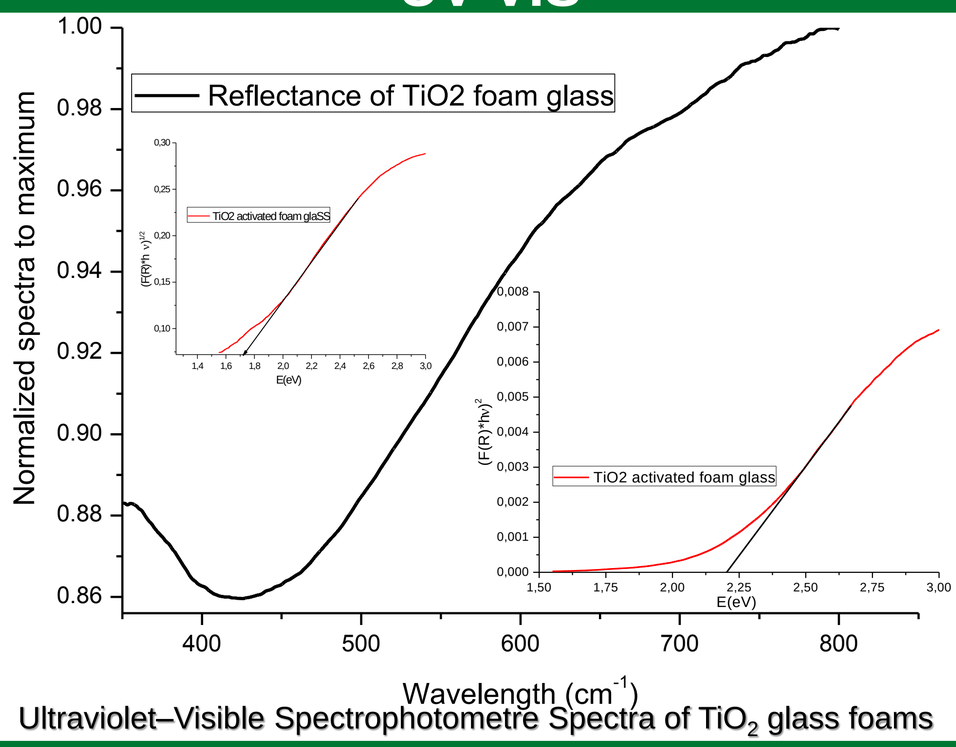
TiO_2 activated foam glass was synthesized by hydrothermal method, using the following reagents:
- Waste glass
- 5% marble
- ethylen glycol

Hydrothermal synthesis
T= 200°C
t = 2 h
Thermal treatment
T= 850°C
t = 30 min

Characterization

- Ft-IR
- Scanning Electron Microscopy (SEM)
- Ultraviolet–Visible Spectroscopy UV-VIS)
- Thermogravimetric Analysis (TGA)
- Raman Spectroscopy

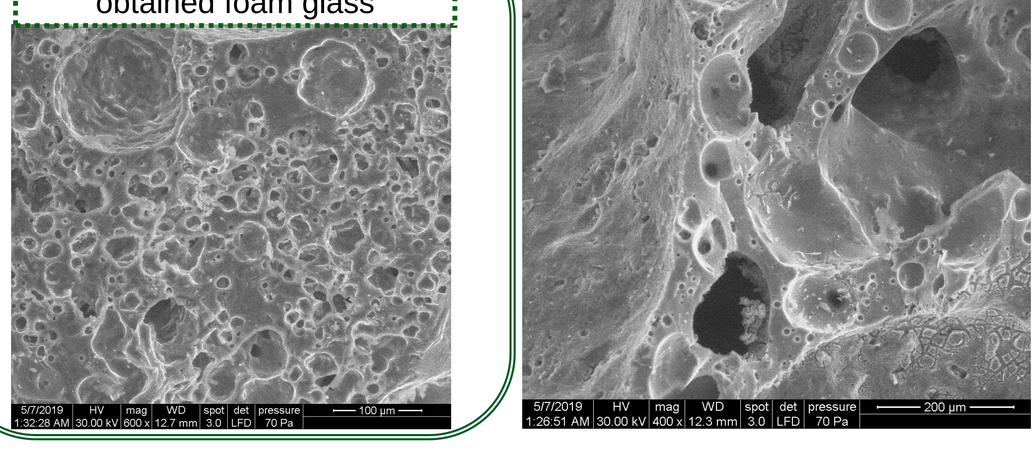
UV-VIS



Ultraviolet–Visible Spectrophotometre Spectra of TiO_2 glass foams

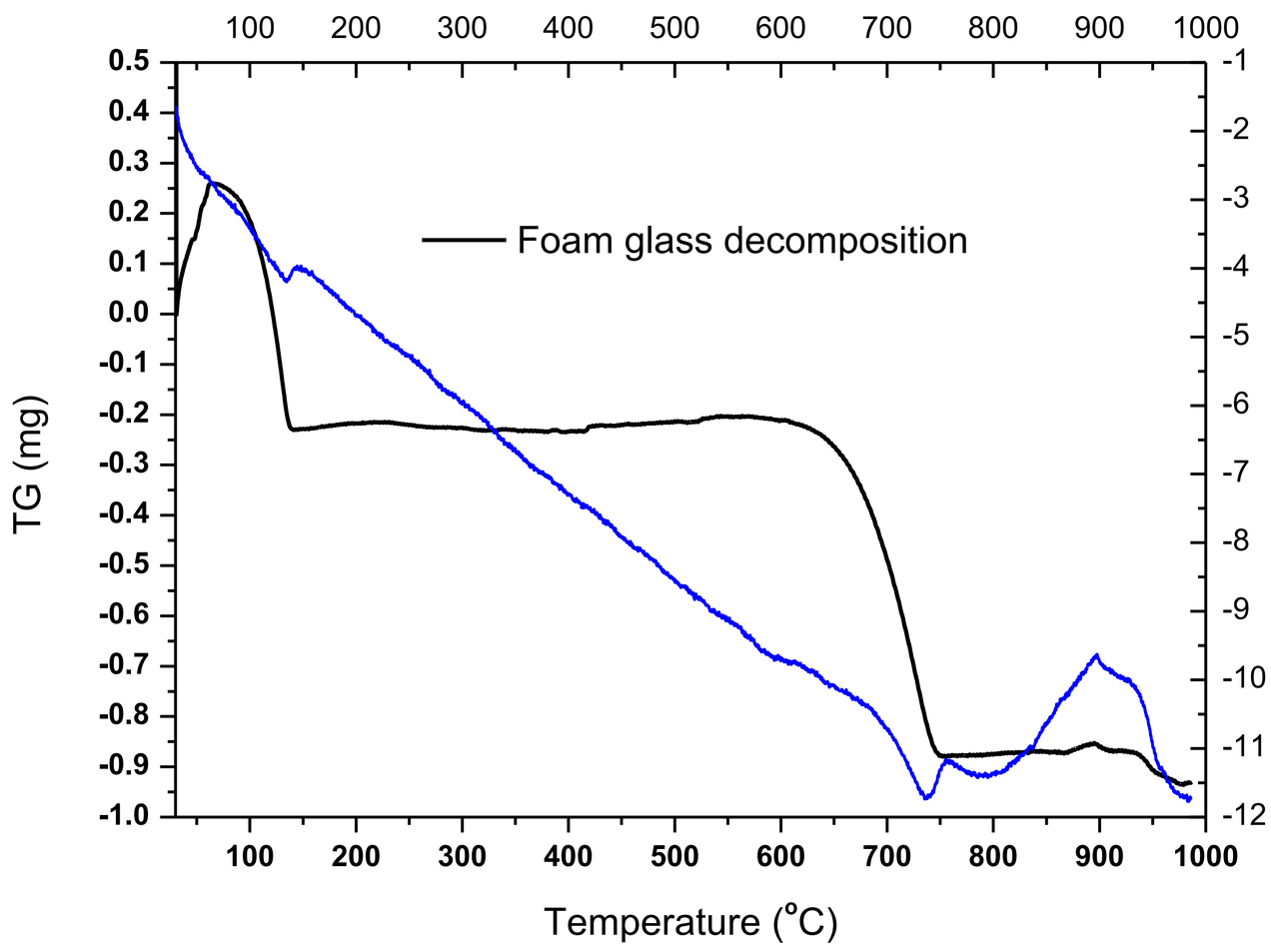
Scanning Electron Microscopy (SEM)

SEM micrographs of as obtained foam glass

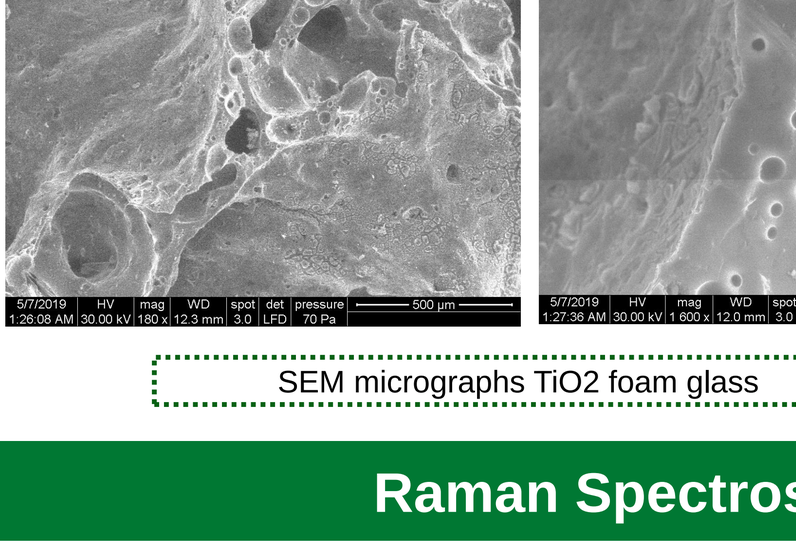


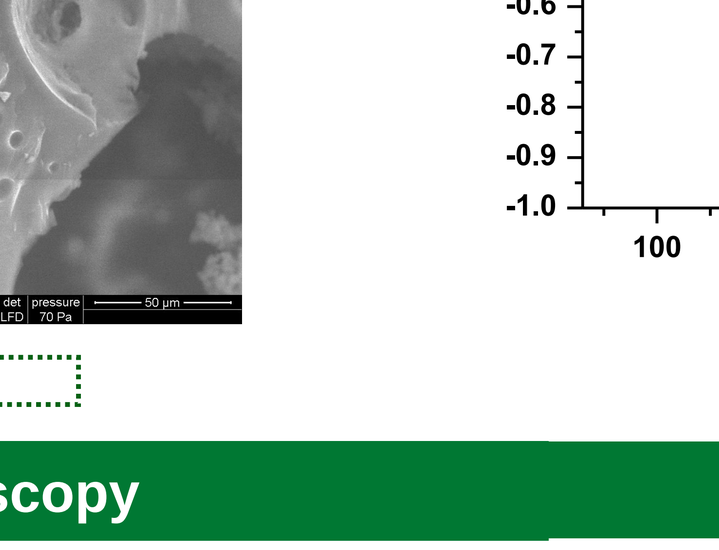
SEM micrographs TiO2 foam glass

Thermogravimetric Analysis (TGA)



Raman Spectroscopy





FT-IR

Summary

- ✓ Our research focus has been mainly on obtaining a photocatalytic activated foam glass with TiO2 as an efficient active photocatalyst material for pollutants remover in building industry from ordinary glass waste coming from automotive industry. detected in the XRD pattern.
- ✓ The FTIR spectrum of TiO2 activated Glass clearly shows tree specific bands. The first band is the broadest, and is observed at 3500 cm^{-1}, corresponding to the stretching vibration of the hydroxyl group O-H of the TiO2 NPs. The second band is observed around 1630 cm^{-1}, corresponding to bending modes of water Ti-OH; the last is a prominent peak at 1383 cm^{-1} related to Ti-O modes [26,27].
- ✓ The anatase phases of TiO2 could be sensitively identified by Raman spectroscopy based on their Raman spectra. According to group theoretical analysis there are six Raman active modes for tetragonal anatase structure. In our recorded spectra were observed only 3 active modes at 395, 514 and 637 cm^{-1} assigned as the B1g, A1g + B1g, and Eg.
- ✓ The band gap of TiO2 activated foam glass from UV-Vis spectra revield a bandgap of 2.2 eV after Kubela-Munk plot
- ✓ The SEM micrographs of foam glass shows many numbers of pores ranging from 10-200 um are uniformly distributed in the foam glass while addition of TiO2 may contribute to a superior physical property of the product because of more uniform surface
- ✓ The results so far suggest that the prepared glass with the hydrothermal treatment can be an excellent and convenient method for fast fabricating at low temperature the porous glass materials

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References

Nadica, D.; Abazovic, M.; Comor, M.; Dramicanin, D.;. Jovanovic, S.; Jovan, M. Photoluminescence of
Anatase and Rutile TiO2 Particles. J. Phys. Chem. B 2006, 110, 25366–25370.
27. Mugundan, S.; Rajamannan, G.; Viruthagiri, N.; Shanmugam, R.; Gobi, P. Synthesis and characterization of
undoped and cobalt-doped TiO2 nanoparticles via sol-gel technique. Appl. Nanosci. 2015, 5, 449–456.

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