ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ
ΤΜΗΜΑ ΕΠΙΣΤΗΜΗΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑΣ ΥΛΙΚΩΝ

ΠΑΡΟΥΣΙΑΣΗ ΜΕΤΑΠΤΥΧΙΑΚΗΣ ΔΙΠΛΩΜΑΤΙΚΗΣ ΕΡΓΑΣΙΑΣ

Τίτλος

Porous Materials for the Catalytic Conversion of CO_2 to Cyclic Carbonates

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Επιβλέπουσα Καθηγήτρια: Μαρία Βαμβακάκη

Δευτέρα 6/3/2023

12:00

Η παρουσίαση θα πραγματοποιηθεί στην αίθουσα **Τηλε-εκπαίδευσης Ε-130, στο κτήριο του Τμήματος Μαθηματικών και Εφαρμοσμένων Μαθηματικών,** του Πανεπιστημίου Κρήτης.

ABSTRACT

The development of novel technologies, based on cutting-edge materials, for CO_2 capture and conversion is necessary due to the escalating emissions of CO_2 that contribute to global warming. Porous organic polymers are ideal candidates for use in CO_2 collection and conversion, because they possess advantageous features, such as large surface areas, narrow pore size distribution, strong chemical and thermal stability and functional groups. The synthesis of porous polymer networks based on porphyrin and aluminum porphyrin moieties is described in this work. First a porous porphyrin network (TMP-net) was prepared by free-radical polymerization of a tetra-methacrylate porphyrin derivative. Next, the TMP-net network was metalated using dimethyl aluminum chloride, to form the aluminum porphyrin-based network (Al-TMP-net). Scanning electron microscopy was used to characterize the morphology of the networks after drying in supercritical CO_2, and Attenuated Total Reflection Fourier-transform infrared, Energy-dispersive X-ray spectroscopy and X-ray photoelectron spectroscopy were used to confirm the successful metalation of the networks. The surface area was measured by applying the Brunauer-Emmet-Teller method to the adsorption branch of the N_2 isotherms of the polymers. TMP-net had a surface area of 622 m^2g^{-1}, while the Al-TMP-net exhibited a lower surface area

at 167 m^2g^{-1}. Additionally, the porous TMP-net absorbed more CO_2 at 273 K compared to the Al-TMP-net (1.54 mmol/g *vs* 0.64 mmol/g, respectively). Both polymeric networks were evaluated for their catalytic performance in the cycloaddition of CO_2 to epichlorohydrin in the presence of tetrabutylammonium bromide. Proton nuclear magnetic resonance spectroscopy revealed that Al-TMP-net had a high catalytic activity, exhibiting 93% conversion, whereas TMP-net gave 88% conversion for the same reaction conditions. Finally, recycling experiments verified the stability of the catalysts for at least 5 runs.