**AIR PURIFICATION USING HYDROLITICALLY STABLE FLUORINATED MOFs**

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**ABSTRACT**

Adsorption on nanoporous materials is considered as a cost efficient, sustainable strategy for gas separations. In this respect, Metal Organic Frameworks (MOFs), a novel class of crystalline porous solids have attracted attention due to their outstanding pore properties such as extensive (micro-) porous networks, high surface areas, tunable pore sizes, facile introduction of surface functionalities etc.1,2

Cryogenic air separation units (ASUs) are abundantly used in the industry to produce pure N2 and O2. Such units require air pre-conditioning (routinely by pressure-swing-adsorption) for removing H2O and CO2. Currently, zeolite 13X is typically used as adsorbent in such systems; however there is a great energy demand for adsorbent bed regeneration.

Herein, we present an extensive study on an advanced air purification system based on a new family of fluorinated metal-organic frameworks **(F-MOFs)** as adsorbents. F-MOFs have a general formula **(MOxF6-x)M’L**, (*x=0, 1, Μ = Al3+, Fe3+, Si4+, Nb5+, M’ = Ni2+, Cu2+, Zn2+, L=pyranize, 4,4’-bipyridine, etc*), exceptional gas sorption/separation properties as well as high thermal and hydrothermal stability.3 These structures are capable to adsorb significantly higher amounts of H2O and CO2 compared to zeolite 13X, while at the same time the required regeneration temperature is 105 oC, instead of 160 oC for 13X.

For the new MOFs, low pressure H2O, CO2 and N2 adsorption isotherms were performed at near-ambient temperatures in order to extract valuable information such as isosteric heats of adsorption Qst, diffusion time constants D, ideal selectivities etc. Furthermore, high pressure isotherms were also carried out in order to evaluate the adsorbent’s gas storage properties including total uptake, working capacity etc. Finally, the adsorption selectivities for several CO2/N2 ratios were determined in situ by mixture breakthrough experiments.

**Acknowledgements**

This research has been co‐financed by the European Regional Development Fund of the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE: PUREGAS project, Application of Novel Porous Materials in Industrially Relevant Gas Separation/Purification Processes (project code:T1EDK-00770).

**KEYWORDS:** Adsorption, Gas separation,MOFs, Breakthrough curves, Air purification

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