Synthesis of Layered Metal Organic Frameworks for Carbon Dioxide Separation *

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Current rising atmospheric CO_2 concentration and its potential dramatic influence on climate change have led to intensive research into materials for CO_2 capture and separation [1], since CO_2 capture and storage (CCS) is anticipated to be an important component of reducing worldwide CO_2 emissions from stationary point sources, such as coal-fired power plants [2].

In this work, we focus on the potential advantages of layered metal organic frameworks (MOFs), which are extended crystalline structures wherein metal cations or clusters of cations ("nodes") are connected by multi-topic organic "strut" or "linker" ions or molecules [3]. MOFs are unparalleled in their degree of tunability and structural diversity as well as their range of chemical and physical properties because of the infinite number of possible combinations brought by the variety of metal ions, organic linkers, and structural motifs [4]. In current study, a new layered metal organic framework, NEU-2, was obtained via hydrothermal synthesis based on cobalt metal source, terephthalic acid as an organic linker, and 1,4-diaminobutane (1,4-DB). It is thought that layers of NEU-2 are bridged by 1,4-diaminobutane molecules. The crystallinity of the material was characterized with X-ray diffraction and data was collected over the 5-50 degrees 2θ range with a step size of 0.1 and scan rate of 1 degree/min. Thermo gravimetric analysis was performed by heating material from 25 °C to 800 °C in a nitrogen stream at a heating rate of 10 °C/min in TA instruments TGA Q500 analyzer. Scanning Electron Microscopy (SEM) has also been taken.

Results show that based on the X-ray diffraction patterns, this synthesis led to a kind of crystalline material. The characteristic peaks corresponding to the layered structures were identified in XRD patterns with an assumption of two 1,4-diaminobutane molecules in between the layers, and this assumption was supported by the results of TGA analysis.

* This work is supervised by Professor Sunho Choi, Department of Chemical Engineering, Northeastern University, MA

References:

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