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Polymer Chemistry 2019: A Triazol containing Uio-type metal-organic framework as highly efficient CO2 capture and catalytic conversion-Pourya Zarshenas- Shahid Beheshti University

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The rising levels of CO2 have been the area of concern globally over several decades now, owing to its obvious detrimental effects in the biosphere. CO2 as the primary dangerous gas has been cited as the leading culprit by temperature increase of the global surface as well as subsequent climate changes. The chemical conversion of CO2 into five membered cyclic carbonates has been widely demonstrated as an industrially important transformation fulfilling typical green chemistry credentials. Metal-organic frameworks (MOFs) are an excited and rapidly growing class of porous crystalline materials that are constructed from multi dentate organic linkers and discrete inorganic nodes. Compared to other porous materials such as zeolites, mesoporous silica and carbon nanotubes, tunable pore size, high porosity and surface area of MOFs make them important candidates for heterogeneous catalysts, gas sorption/storage/separation, chemical sensing, biomedicines, drug delivery and other technologies. There are many known MOFs such as, zeolite imidazolat frameworks (ZIFs), MILs and Zr-based MOFs which exhibit both chemical and thermal stability for certain applications. One family of MOFs which are rapidly extended are Zr based MOFs including UiOs, PCNs, NU-1000 and MOF-808. The interest in these family of MOFs emerges from their thermal, chemical and mechanical stabilities which make them ideal candidates for many applications. In this seminar, a highly porous and stable UiO-66 -type metal-organic framework containing both metal sites (as Lewis acid) and nitrogen rich triazole group (as Lewis base) was successfully synthesized via solvothermal reaction. In comparison with non-functionalized UiO-66, triazole containing UiO-66 MOF exhibit superior catalytic activities in CO2 cycloaddition with epoxides. It was demonstrated that the highly performance of triazole containing catalyst is due to the presence of nitrogen groups of triazole moiety which can act as Lewis base. In addition the catalyst showed excellent stability and easy recyclability in comparison with homogenous catalysts.

Materials. Chemicals were obtained from Sigma–Aldrich (Sigma), Tokyo Chemical Industry (TCI), AstaTech, and Daejung Chemicals & Metals (Daejung). Zirconyl chloride octahydrate ($ZrOCl_2·8H_2O$, 98%, Sigma), 2,5- pyridinedicarboxylic acid (PyDC, 98%, AstaTech), terephthalic acid (98%, BDC, Sigma), 4,4’-biphenyldicarboxylic acid (>97%, BPDC, TCI), N,N-dimethylformamide (DMF, 99.5%, Daejung), benzoic acid (BZA, 99.5%, Sigma) and hydrochloric acid (HCl, 35%, Daejung) were used for the synthesis UiO series MOFs. Potassium permanganate ($KMnO_4$, 99.3%, Daejung) and 5,5’-dimethyl-2,2’-bipyridyl (DMBPy, >98%, TCI) were used for the preparation of 2,2’-bipyridine5,5’-dicarboxylic acid (BPyDC). Pyridine (>99%, Sigma), n-hexane (99%, Daejung) and diethyl ether (99.5%, Daejung) were used for the preparation of 1-methylpyridinium iodide [(MePym)I]. Iodomethane (MeI, 99.5%, TCI), iodoethane (EtI, >99.0%, TCI), 1-iodopropane (PrI, >98.0%, TCI), 2-iodopropane (i PrI, >99.0%, TCI), bromoethane (EtBr, >99.0%, TCI), 1-bromopropane (PrBr, >98.0%, TCI), 1-chloropropane (PrCl, >99.0%, TCI), methyl p-toluenesulfonate (MeOTs, >98.0%, TCI), acetonitrile (MeCN, 99.5%, Daejung) were used for post synthet-