

12th International Conference and Exhibition on **Materials Science and Chemistry**
&
30th World **Nano Conference**

May 20-22, 2019 Zurich, Switzerland

Development of nanoporous & mesoporous materials for environmental applications

Chamila Gunathilake

University of Peradeniya, Sri Lanka

Mesoporous silica materials with various organic pendant groups were developed for interesting applications including high temperature carbon dioxide (CO₂) sequestration from power plant, treatment of wastewater streams, uranium extraction from seawater. Research is mainly focused on the incorporation of metal (aluminum, zirconium, calcium, and magnesium) species into mesoporous silica materials with organic pendant (amidoxime) and bridging groups (isocyanurate, benzene) for CO₂ capture at low (0°C), ambient (15, 25°C) and elevated temperatures (60, 120°C). Amidoxime-functionalized mesoporous silica composites were prepared for the first time by a two-step process. First, mesoporous silica with cyanopropyl groups was obtained by solvent evaporation-induced self-assembly (EISA) and converted to amidoxime functionalized mesoporous silica by hydroxylamine hydrochloride. Aluminium and zirconium incorporated Isocyanurate and benzene bridging mesoporous silica samples and CaO-SiO₂ and MgO/SiO₂ hybrid materials were also synthesized by co-condensation followed by EISA. All these materials showed relatively low CO₂ uptake at ambient conditions. However, they perform very well at elevated temperature (120°C) reaching the CO₂ sorption capacities in the range of 2.15-4.71 mmol/g. Mesoporous silica materials with diethylphosphatoethyl groups (DP-MS) and hydroxyphosphatoethyl pendant groups (POH-MS) were prepared for lead ions adsorption. High affinity of hydroxyphosphatoethyl groups toward lead ions (Pb²⁺) makes the POH-MS materials attractive sorbents for lead ions, which is reflected by high lead uptake reaching 272 mg of Pb²⁺ per gram of POH-MS. Amidoxime-modified ordered mesoporous silica (AO-OMS) materials are also attractive sorbents for uranium recovery as evidenced by very high uranium uptake reaching 57 mg of uranium per gram of AO-OMS under seawater conditions.