We are making a new generation of composite materials in which metal-based nanoparticles (NPs) are supported in porous monoliths. Our composites are based on monolithic, mm-dimension metal-organic frameworks (MOFs, below (a)) incorporating nanoparticles that are embedded (below (b)) throughout the material (e.g. as proved by electron microscopy, below right circled). These composites are very stable and combine the catalytic properties of the NPs with the ability of the support to sift complex mixtures and select individual chemicals for reaction with the NPs as well as to act as an easily recyclable support for catalyst recovery.

Applications of these new composites are expected in diverse fields, including degradation of toxic industrial waste and chemical warfare agents, gas purification and storage, and fuel production. For example, fuel cell technology requires efficient PrOx (Preferential Oxidation) catalysts. This is important because the H\textsubscript{2} stream used to feed fuel cells is often contaminated with CO. You will target a new type of PrOx catalyst in which active NPs are embedded in monolithic MOFs. This is appealing because monoliths offer high densities, surface areas and stabilities as well as unique opportunities for catalyst retention. NPs of, for example, gold will be prepared and used to dope monolithic MOFs. Testing of the new composites in low temperature gas phase PrOx will elucidate kinetics, probe reaction mechanisms, and measure TOFs. Composites will be extensively characterized before and after testing to study stability and reusability.