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Hybrid Inorganic-Organic Metal Phosphates and Phosphonates for Catalysis and Energy Applications.

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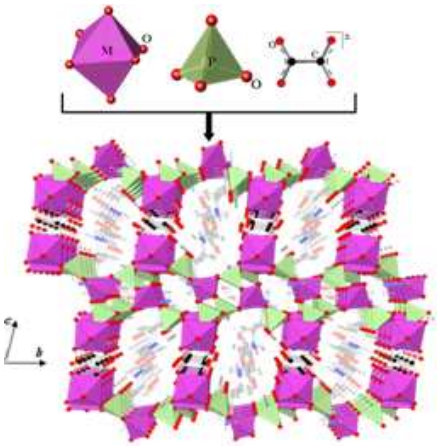
Abstract:

The early focus was in structural hybrid materials based on carbon-silicon networks, but recent efforts have focused on the design of functional hybrid materials that combine the chemical and physical activity of their components. Hybrid frameworks offer a wider range of structures and properties. For example, they can display selective heterogeneous catalysis and their electronic properties have attracted much interest.[i,ii] Research in this area is truly interdisciplinary and involves thorough knowledge of the two worlds of chemistry, organic and organic, each with significant contributions to the field of materials science. The main challenge is identifying the right combination of organic and inorganic molecular building blocks that enhances the properties of each component while reducing their limitations. This challenge provides a unique opportunity for synthetic chemists for developing new materials with synergetic behavior leading to improved performance or completely new properties.

The discovery of aluminophosphates (AlPOs) with zeolite-like structures and their potential applications in catalysis, ion-exchange and gas separation led to extensive research activity in the field of open-framework metal phosphates.[iii,iv] In recent years, significant progress has been made in the area of porous coordination solids formed of molecular building blocks connected by suitable multidentate organic ligands.[v] The combination of the robustness of inorganic frameworks with the versatility and chemical flexibility of organic ligands has led to a number of novel hybrid inorganic-organic open-framework materials, such as phosphonates, aminophosphates, aminoacides, and phosphatodicarboxylates.[vi]



Here, we will describe the design, the synthesis and the structural and thermal stability characterization of some Indium and gallium hybrid phosphates and phosphonates recently prepared in our laboratory. **Figure 1** represents the structure of one of these phases recently prepared through hydrothermal synthesis.

Figure 1. An example of what can be achieved by bringing together inorganic and organic components to form three-dimensional hybrid inorganic-organic open frameworks. In this case we combined gallium with phosphate groups and bridging oxalate ligands to form the compound shown.

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