Synthesis, analysis, and spectroscopy of lead oxides

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Lead oxides, members of the class of conducting metal oxides, are used in a wide array of applications in the field of electronics. Some typical examples of applications include the use of lead oxide as a direct conversion material for X-ray imaging detectors, transparent conducting films that exhibit optical transmission in the visible region and reflectance in the infrared region of the spectrum, and electrochemically-active lead oxide-graphite composite materials. Because of their electronic properties and ability to be synthesized in many forms by a variety of methods, there is great potential for lead oxides to be used for many more applications in the future. Additionally, combining them with other materials may easily result in many more applications as composites.

Lead oxides exist as both lead(II) and lead(IV) oxides in addition to mixed oxidation state oxides. Their various chemical forms exhibit an extremely complex reaction chemistry, including interconversion among different chemical and structural forms as a function of both chemical and physical conditions. The parameters that effect transitions between different chemical and structural forms include heat, time, initial reactants, tribological effects, dopants present during their synthesis, and pH conditions in the case of aqueous syntheses.

This presentation discusses the synthesis, analysis and spectroscopy of lead oxides, including their chemistry, structural forms, and physical properties. The various synthetic approaches are discussed, along with the interconversion of the different forms from one to another. Experimental techniques are described for their analyses, from chemical content, structural and bonding standpoints. Methods are discussed for their synthesis and growth into powders, crystals, and films, while several techniques are described for fabrication of the lead oxides into forms that are useful in various devices.

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