

Answer on Question# 43311 - Chemistry - Physical Chemistry

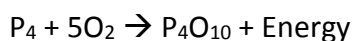
Question:

In order to initiate combustion in solids, it is usually necessary to raise their temperature by means of an external heat source. Under certain conditions, however, some material may generate the necessary heat internally. Give two examples of materials that can exhibit this phenomenon. In each case state how internal heating arises and outline the precautions that should be taken when they are stored to prevent combustion from occurring

Answer:

1) White phosphorus autoignition:

White phosphorus consists of tetrahedral molecules P_4 with relatively weak bond energy and weak intermolecular interactions. Therefore, it starts to oxidize even at room temperature. This process heats the sample of white phosphorus, and finally when the temperature reaches $34\text{ }^\circ\text{C}$ ($93\text{ }^\circ\text{F}$) it ignites itself and starts to burn:



To prevent this reaction, the white phosphorus is stored under the water layer.

2) Will-o'-the-wisp:

Some solids do not ignite themselves, but are capable of releasing the pyrophoric gases that ignite the source of their origin. This effect can be observed in marsh and grave lights, called will-o'-the-wisp. A will-o'-the-wisp is atmospheric ghost light seen by travelers at night, especially over bogs, swamps, marshes and graveyards.

This effect occurs due to the organic matter decomposition, which releases the considerable amounts of phosphine PH_3 capable of autoignition. This process occurs when the temperature reaches $38\text{ }^\circ\text{C}$ ($100\text{ }^\circ\text{F}$) according to the following equation:



The burning phosphine and other evolved gases can ignite the combustible solids such as peat or twiglets and thus cause conflagration. It is very difficult to prevent such type of autoignition. One of the ways is to avoid the accumulation of large amounts of organic wastes at closed area.