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Publisher Taylor & Francis

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## Phosphorus, Sulfur, and Silicon and the Related Elements

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713618290>

### Synthesis and Oxidation in Air of Copper(I, II) Monophosphate, $\text{Cu}_2\text{PO}_4$

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**To cite this Article** Sinyayev, Vladimir A. , Levin, Vladimir L. and Shustikova, Elena S.(1999) 'Synthesis and Oxidation in Air of Copper(I, II) Monophosphate,  $\text{Cu}_2\text{PO}_4$ ', Phosphorus, Sulfur, and Silicon and the Related Elements, 147: 1, 473 — 474

**To link to this Article:** DOI: 10.1080/10426509908053716

**URL:** <http://dx.doi.org/10.1080/10426509908053716>

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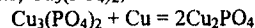
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## Synthesis and Oxidation in Air of Copper(I,II) Monophosphate, $\text{Cu}_2\text{PO}_4$

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Copper(I,II) monophosphate,  $\text{Cu}_2\text{PO}_4$ , was synthesized by the reduction of copper(II) monophosphate,  $\text{Cu}_3(\text{PO}_4)_2$ , with metallic copper via reaction



The mixture of reagents was heated at 900°C in alumina crucible in an inert atmosphere. The obtained copper phosphate melt was poured out in massive copper mould and crystalized with natural rate of cooling to room temperature. It was received crystalline ingot of salt which includes the brown crystalls of  $\text{Cu}_2\text{PO}_4$  and small pieces of metallic copper. The structural analyses of  $\text{Cu}_2\text{PO}_4$  crystals which was performed by professor E.Holt from Oklahoma State University confirmed the nature of salt.

The behaviour of obtained material on the base of  $\text{Cu}_2\text{PO}_4$  when heated in air was studied. It was found that material adsorbs atmosphere oxygen at heating in air starting 130-160°C. The oxidation rate increases with the encrease temperature. Oxidation mainly takes place in the layers of particles disposed at/and near the surface. The result of long-time heating of the  $\text{Cu}_2\text{PO}_4$  based material at 700°C is a formation of two types of oxidized surface regions, one is wavy and the other is covered with long black fibres. The oxidized particles have lamellae construction.

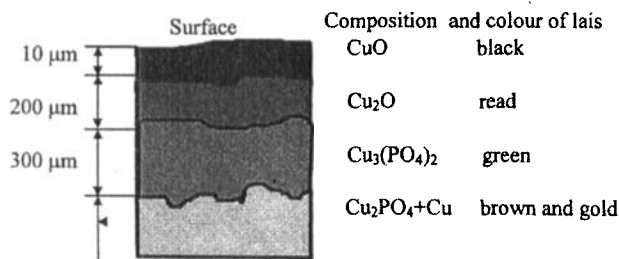


FIGURE Construction of oxidized material.

The main stages of oxidation process of  $\text{Cu}_2\text{PO}_4$  based material are the following:  
 - disproportion of starting salt to copper (II) monophosphate and elemental copper due

to reaction  $2\text{Cu}_2\text{PO}_4 = \text{Cu}_3(\text{PO}_4)_2 + \text{Cu}$ ;

- diffusion of elemental copper to the surface and into the depth of the particles;
- oxidation of metal located near the surface to  $\text{Cu}_2\text{O}$ ;
- oxidation of outside layer of  $\text{Cu}_2\text{O}$  to  $\text{CuO}$ ;
- formation of large crystals of  $\text{Cu}_3(\text{PO}_4)_2$  under the copper oxide layer.

The inside regions of oxidized particles consist of the crystals of initial  $\text{Cu}_2\text{PO}_4$ , metallic copper and  $\text{Cu}_3(\text{PO}_4)_2$ . The result of long-term heating of  $\text{Cu}_2\text{PO}_4$  at 900-1000°C is full oxidation of salt to copper (II) oxophosphate