PHYSICS

Invisible Light Found to Pierce Thin Metal Films

Discovery at Johns Hopkins Results in Creation of New Research Tools For Filtering Ultraviolet and Infrared

NEW tools for the study of invisible light rays have been placed in the hands of science as a result of researches on the optical properties of metals by two physicists at Johns Hopkins University. Prof. R. W. Wood has found that thin films of the alkali metals possess the unique property of being transparent to ultraviolet light, and a colleague, Prof. A. H. Pfund, has succeeded in preparing powder films of silver, gold, and several other metals that are transparent for the infrared or heat rays. Both types are opaque to visible light.

The value of these filters in scientific research lies in their ability to remove the visible rays from a beam of light. Visible light is almost always produced in sources of infrared or of ultraviolet light and frequently causes disturbances in measurements. Of the few materials now known which are capable of transmitting ultraviolet but not visible light one is a nickel oxide glass invented by Prof. Wood. The new alkali metal filters transmit a wider range in the ultraviolet spectrum than any filters of this type previously available. Technical applications, such as photoelectric counters operating with invisible beams, may be expected to follow.

The alkali metals, lithium, sodium, potassium, rubidium, and caesium, are soft, lustrous, highly reactive materials now used extensively in the production of photoelectric cells. A sixth member in this chemical family, element number 87, has not yet been isolated. The preparation of thin films of these metals was achieved by Prof. Wood by an ingenious method in which the metal is heated in a quartz bulb, the top of which is cooled to the very low temperature of liquid air. The metallic vapor condenses on the cold wall, forming a film whose thickness can be varied by regulating the heating of the metal. The operation is carried out in a vacuum. Films a hundred-thousandth of an inch thick, of each of the five alkali metals, were made in this way.

Prof. Wood discovered that all five of these metals were transparent to ultraviolet light, but the point in the spectrum at which they become transparent depends on the metal. Thus lithium, the lightest element in this group, transmits only the short wavelength part of the ultraviolet region, while for caesium, the heaviest member, the transition point occurs in the visible part of the spectrum. In addition to the ultraviolet, caesium transmits violet light and films of this metal are described as having a rich violet color.

Deposited on Nitrocellulose

This investigation included the study of various other optical properties of the alkali metals, such as reflecting power and interference phenomena. It was from observations of the latter that it was possible to determine the thickness of the films.

The infrared filters studied by Prof. Pfund consist of deposits of metallic powders on thin films of nitrocellulose. The nitrocellulose film, too thin to show interference colors, is floated in a dish of mercury above which is suspended a conical tungsten filament containing the metal to be deposited. On heating the filament the metal suspended in it vaporizes and deposits on the film in the form of a black powder, the particles in which are too small to be seen through a microscope. The trick in this preparation lies in having the pressure of hydrogen or air in the chamber exactly right at about three millimeters of mercury (one-eighth of an inch). Films of gold, silver, nickel, copper, zinc, cadmium, lead, bismuth, antimony, selenium, and tellurium were produced.

Zinc Altogether Opaque

All of these were opaque to visible light and transmitted the long wavelength heat rays except zinc. The zinc films were opaque over the whole region. However, this property of zinc black will make it useful, Prof. Pfund believes, for coating the receiving areas of infrared detectors such as thermopiles and radiometers since zinc black is capable of transforming the infrared radiation into actual heat.

An unexpected result was found in the study of powder films made of coarse particles. A quartz film, having a particle diameter of two ten-thousandths of an inch, transmitted only a very narrow band of wave-lengths in the infrared.

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PALEOBOTANY

Carbonized Tree Found In Rim of Crater Lake

A CARBONIZED tree still standing on its roots, recently discovered within the rim of Crater Lake, is considered one of the most important finds made in the area of Crater Lake National Park since the lake was first discovered by white men in 1853.

When first observed, only a portion of the log was exposed. Excavation and examination showed it to be the stump and bole of a prehistoric tree. It is 31½ inches in diameter at the top and 15½ at the base, with a total length of 52 inches. Only the top part was carbonized, the lower section, including the huge branching roots, being uncarbonized and more or less decayed.

Park Naturalist D. S. Libbey states that the location of a carbonized log within the crater slope surrounding Crater Lake, with a stump and roots uncarbonized and partially decomposed, presents many problems.

Indications are that the tree was growing on a glaciated surface covered with glacial debris. Cool volcanic material tumbling down the slope covered its roots and base. Later, hot volcanic material settled around the remainder of the tree so quickly that air was excluded, combustion was prevented, and carbonization resulted.

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