ART. XXXIX.—*On the Optical Properties of the Picrate of Manganese;* by M. CAREY LEA, Philadelphia.

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BREWSTER and HAIDINGER have described a remarkable property possessed by certain crystalline surfaces, of reflecting, besides the ray normally polarized in the plane of incidence and reflection, another ray, polarized perpendicularly to that plane, and differing from the former in being colored, a property rendered more conspicuous by the fact that the color of the ray so polarized abnormally is either complementary to, or at least quite distinct from the color of the crystal itself.

I find that this property is possessed to a remarkable degree by the picrate of manganese. This salt crystallizes in large and beautiful transparent right rhombic prisms, sometimes amber-yellow, sometimes aurora-red, exhibiting generally the combination of principal prism, and macrodiagonal, brachydiagonal and principal end planes. In describing this substance in a paper on picric acid and the picrates,* I mentioned that in a great number of specimens examined, no planes except those parallel with or perpendicular to the principal axis had been met with. Since then I have obtained in several crystallizations specimens exhibiting a brachydiagonal doma, but this appears to be rather unusual.

The optical properties of this salt are very interesting. It exhibits a beautiful dichroism. If the crystal be viewed by light transmitted in the direction of its principal axis, it appears of a pale straw color, in any other direction, rich aurora-red in some specimens, in others salmon color. A doubly refracting achromatised prism gives images of these two colors, except the light be transmitted along the principal axis of the crystal of picrate, in which case both are pale straw color.

But it also possesses in a high degree the property of reflecting two oppositely polarized beams, and the great size of the crystals in which it may readily be obtained, renders it peculiarly fitted for optical examination. If one of these crystals be viewed by reflected light while it is held with its principal axis lying in the plane of incidence and reflection, the reflected light is found to be not pure white, but to have a purple shade. Examined with a rhombohedron or an achromatised prism of Iceland spar, having its principal axis in the plane of incidence and reflection, the ordinary image is white as usual, while the extraordinary is of a fine purple color, the phemenon having the greatest distinctness when the light is incident at the angle of maximum polarization.

* This Journal, Nov., 1858.

The experiment may be varied and the purple light beautifully seen without the use of a doubly refracting prism by allowing only light polarized perpendicularly to the plane of incidence to fall on the crystal; in this case the surface of the crystal appears rich deep purple, no white light reaching the eye.

This property is not possessed by all the planes of the crystal, but is limited to the principal prism and brachy- and macrodiagonal end planes, in other words to the planes parallel with the principal axis of the crystal. The brachydiagonal doma and $0P$ planes do not possess it. Nor is it exhibited by the first mentioned planes, when the crystal is turned with its prismatic axis at right angles to the plane of incidence.

All specimens of picrate of manganese do not possess this property to an equal extent. The crystals vary considerably in color, and those which are full red exhibit it more strongly than the amber colored. Picric acid boiled with aqueous solution of cyanhydroferric acid and saturated with carbonate of manganese gives crystals of a rich deep color, which exhibit the purple polarized beam particularly well.

These properties are not possessed by the manganese salt alone, but also by the picrates of potash and ammonia, (especially when crystallized by very slow spontaneous evaporation in prisms of sufficient size) and the picrates of cadmium and peroxyd of iron —with this difference however, that while the prismatic axis of the crystal in the case of the cadmium and manganese salts must be in the plane of incidence, in the alcaline salts it must be perpendicular to that plane. As they all crystallize in the right rhombic system, it is probable that either the alcaline salts on the one hand, or the manganese and cadmium or the other, are prismatically elongated in the direction of a secondary axis.

It is convenient that distinct phenomena should have distinct names, and none appears to have been assigned to this. Brewster speaks of it as a "property of light," and Haidinger uses the word "Schiller" for it. The terms dichroism, trichroism and pleiochroism are limited to properties of transmitted light. I therefore suggest for that here in question the name *catachroism*, using the preposition κατα in the same sense as in the word κατοπτριζω, to reflect, (as a polished surface,) applying it to express the property of reflecting two beams, one normally polarized in the plane of incidence and the other polarized in a plane perpendicular to it.

The chromatic properties exhibited by the picrates of ammonia and potash are very remarkable in their variety. Their crystals possess:—

1st. The well known play of red and green light. If a little very dilute solution of pure picrate of potash be spontaneously

evaporated in a hemispherical porcelain basin, so as to form a net work of extremely slender needles, and these be viewed by gas light, the play of colors is singularly brilliant.

2d. Dichroism. When by spontaneous evaporation of large quantities of solution of potash, or better, of ammonia salt, transparent prisms of $\frac{1}{12}$ to $\frac{1}{10}$ inch diameter are obtained, these, viewed with a doubly refracting prism by transmitted light give two images, one pale straw color, and the other deep brownish red.

3d. The above described property of catachroism, or reflection in the plane of incidence of oppositely polarized beams.

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