THE COLOR OF SULPHUR VAPOR.[1]

BY JAS. LEWIS HOWE AND S. G. HAMNER.

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OUR attention was some time since called to a curious difference of opinion on the part of chemical authorities as to the color of sulphur vapor. In twenty-nine standard text-books and reference books examined which mention the color of the vapor, thirteen different colors are given, as follows:

	Authorities.
Deep yellow	4
Orange	5
Orange to dark yellow	1
Orange-yellow	2
Brownish yellow	6
Yellowish brown	1
Amber	2
Yellowish red	1
Red	1
Deep red	2
Deep red to brown	1
Brownish red	2
Reddish brown	1

In no work was any mention found of a change in the color of the vapor with changing temperature.

In order to examine the true color of the vapor a number of experiments were carried out, which, while not complete or entirely satisfactory, nevertheless throw some light upon the discrepancies cited. The first apparatus used consisted merely of a small test-tube of hard glass, within a larger tube, also of hard glass, the smaller tube being held free from contact with the larger by means of a wire frame. The ends of both tubes were stopped with asbestos wads to prevent free circulation of the air. A piece of roll sulphur was placed in the inner tube and heated by Bunsen burners. The pure sulphur vapor could be seen in the inner tube, the hot air in the outer tube preventing the condensation of the vapor on the sides. This simple apparatus gives a good view of sulphur vapor up to the softening point of the glass. The second form of apparatus used was

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a porcelain tube two cm. in diameter and sixteen cm. long, with the ends covered by thin sheets of mica, and the whole tightly packed in a larger iron tube by clay. The inner tube was thus not sealed perfectly, but permitted the escape of the excess of sulphur vapor on heating, though under some considerable pressure. The apparatus was heated in a muffle whose rear end was replaced by a sheet of mica. It was thus possible to have a clear view through the tube while it was heating. The temperature was gauged approximately by tubes of silver chloride (melting-point 457°), lead chloride (melting-point 498°), and potassium iodide (melting-point 634°).

In every case the sulphur, when just beginning to boil, gave a vapor which would perhaps be denominated orange-yellow. This color is almost exactly matched by a normal solution of potassium bichromate. As the temperature increases the color very rapidly deepens and loses every vestige of the yellowish tint. This corresponds to a temperature not much above 457°. On raising further the temperature, the color deepens further. The deepest color was found by several experiments to be at the temperature of about 500° (lead chloride just fused). The paler red color is matched by a solution consisting of

	Parts.
Ferric chloride (normal solution).....	1
Potassium thiocyanate (normal solution)..	2
Water.....	312

The deepest red is matched by a solution:

	Parts.
Ferric chloride (normal solution).....	1
Potassium thiocyanate (normal solution)..	2
Water.....	250

This is as far as the changes can be observed in the test-tubes. Heated in the muffle, immediately above 500°, the vapor begins to grow perceptibly lighter, at 634° being almost straw-color. Up to this temperature the escaping jet of sulphur vapor indicated that the tube must be filled with sulphur vapor. When this jet ceased the results became too doubtful to record. That the rapidly decreasing intensity of color was not due merely to decreasing pressure is evidenced by the fact that the color of the vapor at its darkest point was almost exactly the same in the

porcelain tube and in the test-tube, in the latter case the vapor being practically at atmospheric pressure.

The cause of the different colors applied to sulphur vapor is doubtless due to three causes :

1. The general difficulty of describing the colors of vapors, the relative intensity of which is so much less than that of our ordinary standards.

2. The fact that the color of sulphur vapor varies with the temperature.

3. Sulphur vapor condenses so readily that when boiled in a test-tube the sides of the tube are covered with a layer of the brownish red liquid, which has doubtless sometimes been mistaken for the vapor. Similarly, when sulphur fumes escape from a hot covered crucible into which sulphur has been thrown, it is the condensing sulphur mist, very deep red in color, which one sees, and not the true vapor of sulphur.

The conclusions of this paper are that the color of sulphur vapor varies with the temperature, being of an orange tint just above its boiling-point, deepening to a red which is strongest at 500°, and then becoming rapidly lighter with increasing temperature. The color at the boiling-point is that of a normal solution of potassium bichromate; that of the deepest red is that of a rather dilute solution of ferric thiocyanate.

It is hoped it may be possible to carry these experiments further, but no reservations are made of the subject if others are interested.

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THE FORMATION OF ALUMS BY ELECTROLYSIS.[1]

BY JAS. LEWIS HOWE AND E. A. O'NEAL.

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THE work herein described had for its special end the formation of alums of manganese, and while, in this particular, success was not attained, it is felt that it is well to place the work on record, especially as phases of it are capable of further development, from which interesting results may be hoped.

Manganese salts in which the metal is trivalent, are not very satisfactorily known. Potassium and ammonium manganic

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