

I have just got a large number of properly made cells (ebonite), & as their insulation is good, the measurement of the EMF may prove satisfactory. A few days ago, I abandoned the photographic plates and tried "fluorescent plates", making emulsions of Eosine, Fluoresine, & Alphathaline Red, with pure gelatine. Of course on closing the circuit a polarisation current sets up. Generally this nearly disappears in a few minutes. Blue and ultra blue rays falling on a silver plate coated with Eosine emulsion give currents of a most marked character, the direction being in the cell, from uncoated to coated plate; and these currents are opposed to the polarisation current (always, I believe, certainly they have been in any experiments I can remember). I have found the currents [excluding small they appear to be] produced by light falling on clean platinum plates to be always in the same direction as the pol. current. Alphathaline Red on silver plate gives also very good result, but not so good as Eosine. Fluoresine gives bad result.

None of these give good results with platinum plate.

The great peculiarity of the fluorescent plate is its permanence. I used yesterday with great effect a plate wh. I coated a fortnight ago. It contains a very thin coating of Eosine, but the result appeared to be as good as ever; the spot is driven

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Φ,

London, Sunday,
May 9, 1880.

I brought forward an account of my work yesterday before the Physical Society (Sir W. Thomson) in the Chair. I explained that my first experiments had for object the production of currents by the photographic action slight on silver salts. The fact of the existence of these currents had been proved by me before I knew that Bequaert had previously ascertained it. However, I am not sure that he used the ordinary photographic emulsions; in several of his experiments on AgCl and AgBr I know that he did not.

The elementary facts about these currents are that in a cell containing a silver plate (silver foil fixed by pitch on glass) sensitised with an emulsion of AgCl, in presence of an uncoated silver plate, the liquid being water + a very few grains of common salt, the current runs in the cell from the uncoated to the coated plate. This is also the direction of the current in a cell in which the plate is coated with AgBr ("Liverpool Emulsion"), the conducting liquid being water + a very few grains of KBr.

These were obtained also obtained by Bequaert, but he found that the direction was altered by the thickness of the layer of the silver salt on the plate. I did not observe this.

I found that the direction of the current was reversed when the plate was coated with AgI, the liquid being

water & a very few grains of KI, and in this connection I observe that the heat of combination of Ag and I is very much smaller than the heat of combination of Ag and Cl.

To ascertain the effect of passing an electric current through a plate coated with Ag Br, I took two such plates, immersed them in a cell and connected (for about 4 seconds) one of them with the carbon & the other with the zinc pole of a bichromate cell. The result was that during the passage of the current the plate connected with carbon pole became visible & blackened in the portion of it wh. was immersed in the liquid, the portion above the liquid being quite unaltered; and that no visible effect whatever took place on the plate connected with the zinc pole. When, however, this latter plate was taken out of the cell and developed by pyrogallic acid, a photographic decomposition gradually appeared, exactly as in photography, on the portion wh. was immersed in the liquid, and that the remaining part of the plate was not ^{affected by the developer.} ~~developed~~.

In the problem of the electric transmission of a photographic action to a distance it is of cardinal importance to ascertain whether the effect of the current is localised on the receiving plate, and does not spread generally over the whole plate.

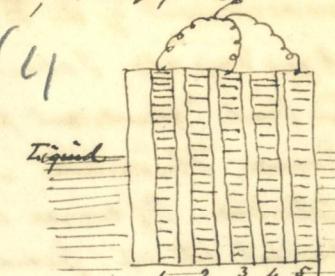
For this purpose I placed several separate silver strips side by side on the plate, as in figure, and connected strips 1, 3, 5 with a wire proceeding from the zinc (or carbon) pole of cell, the whole plate being uniformly coated with the emulsion Ag Br. The decomposing effect manifested itself on the strips in circuit, & only on the immersed portions of these strips.

A plate (with two such strips) I exhibited yesterday at the Physical Society.

With regard to the intensity of the current produced by a luminous source at different distances from a photoelectric cell, Dequervel says that he did not observe any law of connection. Theoretically, it would appear that the current should vary as $\frac{1}{r}$. For let Q be intrinsic energy [quantity of light] in the source, r = distance from cell; then the energy falling on the cell is prop. to $\frac{Q}{r^2}$; and if R = resistance of circuit, I = current, the energy of the current is RI^2

$$\therefore RI^2 = \frac{Q}{r^2} \quad \therefore I \propto \frac{\sqrt{Q}}{r}$$

I varied Q by burning two, three, &c. pieces of magnesium wire instead of one. I made only 3 or ⁴ exp. wh. roughly seemed to fit the law. I used a battery of small cells arranged on circles of varying radii. This experiment I performed with rather imperfect cells, but



completely off the screen from one end to the other;
 & the effect lasts as long as the light keeps up,
 varying with every slight change in it. If I can
 succeed in keeping the emulsion from creeping into
 the water, I think that the fluorescent plate may
 prove a valuable photo-register.

Another strange thing about these plates is their
 contrast with the "dry plates" in photography. The
 gelatine in them may be left exposed to hot sun
 light for days or weeks, and they become so dry
 that you can rub yr finger over them without
 injuring the film; yet they give just as violent
 currents as ever, although the photographic dry
 plates give absolutely none.

If the result is due (or partly due) to any chemical
 action on the Silver, it is exceedingly subtle; for
 the emulsion can be easily removed by the wet
 finger, & the plate seems quite clean & unacted
 upon.

I think that it is not a chemical action at all,
 but the result of a harmony between the vibratory
 motion of a disturbed Silver molecule and the
 molecule of Rosine. What do you think of this
 idea? This harmony, I presume, does not exist
 with platinum molecule as the currents are very
 bad with a platinum plate.

[I don't say that tap water is the liquid I have
 used in fluorescein all; but a better liquid may be

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found; perhaps very salt water won't keep the Eosine on the plate, but if the plate is allowed to dry for days so that the film is quite hard the eosine comes off very little].

I shall try phosphorescence also as a source. Sir W. Thomson said, when I declared my intention of doing this, that it w^t be exceedingly interesting; & he remarked that phosphorescence is a most perplexing phenomenon, on account of its long duration.

I don't see the difficulty. It is an absorption of motion by swinging molecules. I think that those molecules may be like pendulums balanced on extremely smooth axes wh. will swing much longer than pendulums on rough ones.

What do you think of this molecular pendulum notion? It is not in conception wholly new, but its application here may be; and I think that we must distinguish the different durations of molecular swinging in different bodies, as we do in cases of ^{pendulums} freely & body suspended.

Tell me your notion about this at once. It seems to be right, or at least possible.

These objeta membra may serve you with materials for a 5 minutes' speech at R.D.S. Of course I tried red rays with Eosine Fluorescent Cell. No result. A hot iron ball 10 inch from cell — absolute no result. Hc., Hc.

With atoms.

Please observe that the time spent at these fluorescent exp^ts has been altogether too short to enable me to try all that I mean to try in them.

M.

I forgot to say that the decomposition of receiving plate was also effected by photographic current, in less degree. Hold the plate up to the gas for 10 seconds before allowing the current to pass, & ^{after current has passed}, then develop, as before.

I think I said in a former letter that when the Eosine is in the cell, instead of on the plate, the current is reversed. I am doubtful of this. Subsequent exp^ts don't verify it; but probably something depends on the strength of the solution.

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