12. Reaction

Sergey Andguladze,
Georgian Lyceum of Science and Technology,
Tbilisi School №42 Named After I. Vekua

The mostly evident process in this problem is the change of color during reaction.

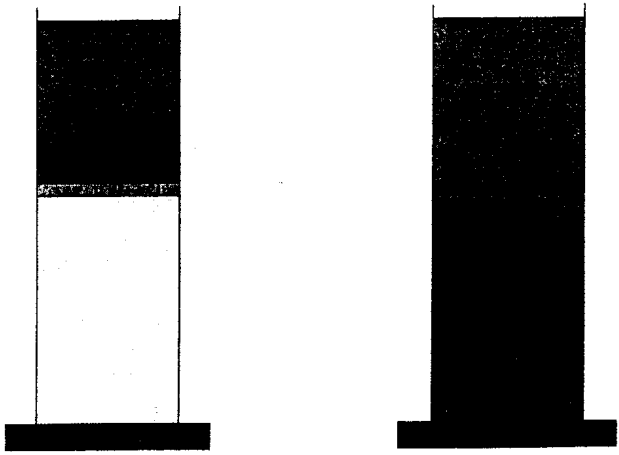
At the beginning of the reaction we have gelatin of yellow color in which there is a iodide of potassium and above it there is copper vitriol of blue color.

Now let us consider which products we will get at the end of reaction.

$$2CuSO_4 + 4KJ = 2K_2SO_4 + Cu_2J_2 \downarrow + J_2 \uparrow$$

As we can see we got precipitation Cu_2I_2 at the surface of gelatin. That is why we see brown color on the surface of the gelatin. During reaction we observe the change of copper vitriol from blue to green. It is caused by separation of iodine. At the and of reaction we see that the color of copper vitriol has changed into dark red, which also caused by active separation of iodine. At the end of reaction gelatin, in it's turn, changes color from yellow to brown. It is caused by precipitation which has brown color and by existence of K_2SO_4 in gelatin and by the rest of iodine.

during reaction **end of reaction**

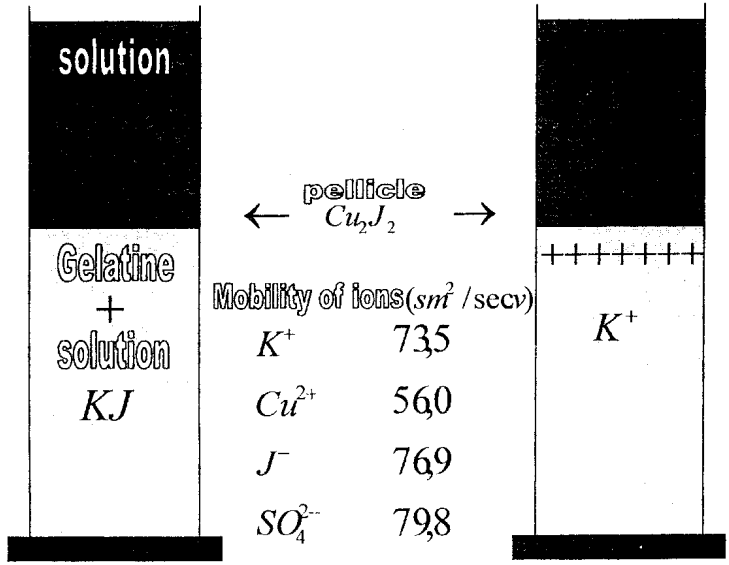


One more process, which we can observe in this problem, is formation of periodical layers, which have different colors. These layers are called rings of Lisegung. This rings are formed because of periodical precipitation. Periodical precipitation proceeds by the following principle: solution of copper vitriol lowers down and reacts with solution of potassium iodide and solution of supersaturated concentration is formed. And this solution precipitates. Then copper vitriol passes to the next layer of potassium iodide, but this layer is already poor. Then copper vitriol passes to the next layer of potassium iodide, where it reacts against and solution of supersaturated concentration is formed again and precipitation takes place too. Such process take place periodically and layers of different color , which are called Lisegung's rings are formed.

Lisegung's rings.

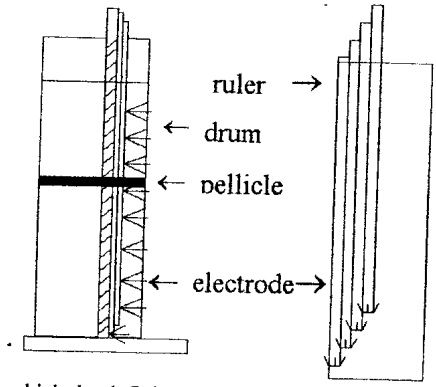
Let us consider once more what products we will get at the end of reaction.

$$2CuSO_4 + 4KJ = 2K_2SO_4 + Cu_2J_2 \downarrow + J_2 \uparrow$$

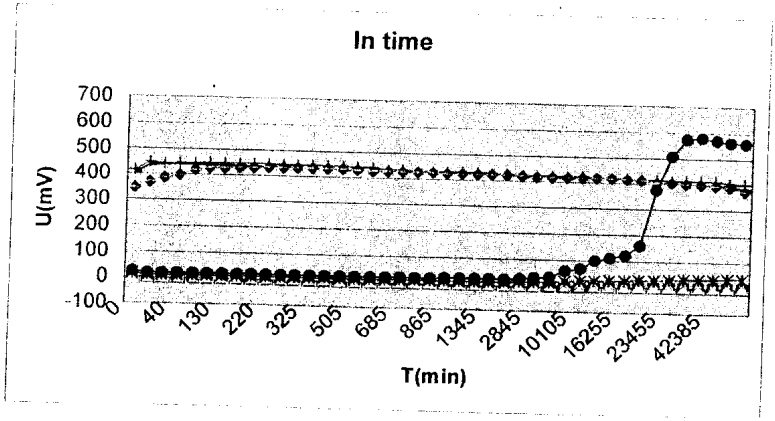


As we can see instantaneous formation of precipitation Cu_2I_2 and volatilization of I_2 happens. Precipitation Cu_2I_2 with the surface of gelatin forms hard passable pellicle for ions K^+ in gelatin and ions of SO_4^{2-} solution of copper vitriol. That why accumulation of ions of opposite sign is formed on the both sides of pellicle. Big potential jump is formed on the boundary of two mediums. Nevertheless ions of SO_4^{2-} pass down through this pellicle due to its mobility and it is confirmed by experiment.

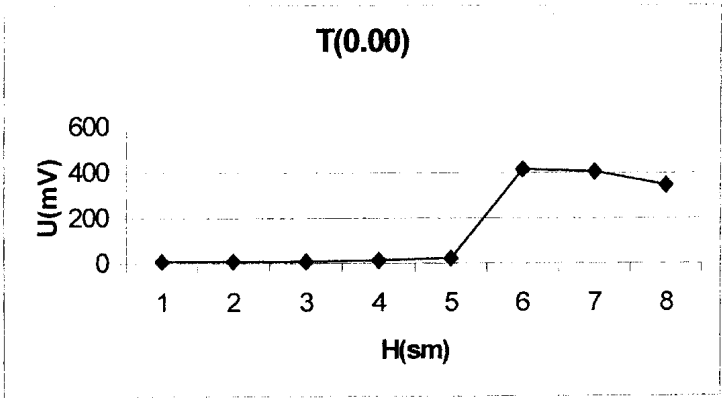
To reveal this jump we constructed the following device.

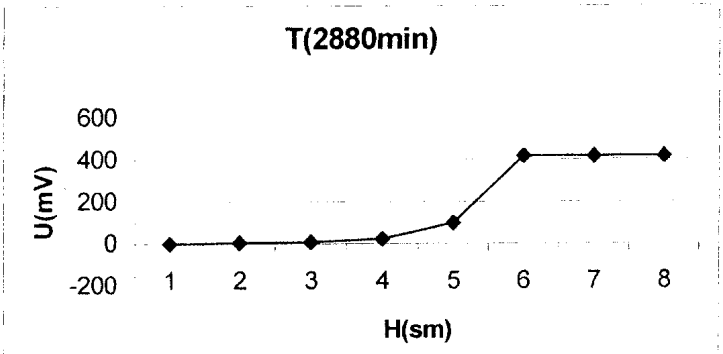


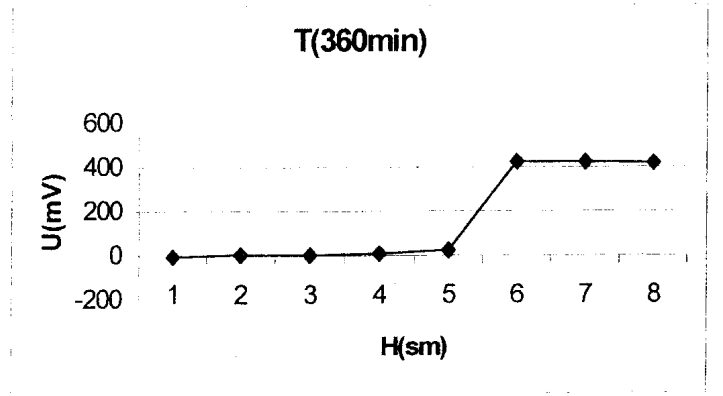
There is a wooden ruler on which the definite number of electrodes is fixed on the definite distance from each other. This ruler with electrodes is put into the cylinder Gelatin with potassium iodide and solution of copper vitriol is pored into this cylinder. After that the potential difference relatively to the first electrode is measured.
On this graph you can see how this jump changes in time.

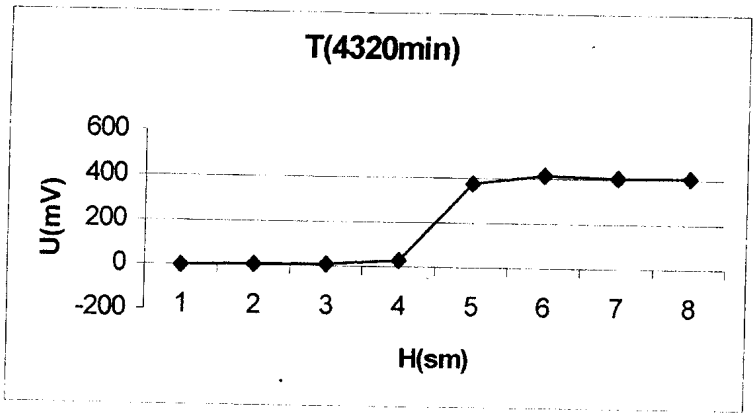


During some time it reaches maximum and then begins to decrease.


T(0.00)
600
400
200
0
U(mV)
1
2
3
4
5
6
7
8
H(sm)


T(2880min)
600
400
200
0
-200
U(mV)
1
2
3
4
5
6
7
8
H(sm)


T(360min)
600
400
200
0
-200
U(mV)
1
2
3
4
5
6
7
8
H(sm)



Acknowledgements

I am thankful to Professor Kokhta Japaridze for the very interesting and stimulating consultations. I am grateful also to Nick Sambelashvili for criticism and many interesting questions and advises.