The electrolysis of copper from copper sulphate solution essay sample

Plan:

The experiment that I have carried out is to find out how different concentrations of copper sulphate affect the electrolysis of copper. To measure the affect that the different copper sulphate solution concentrations have on the electrolysis of copper, I will use current as my unit of measurement to see how the experiment was affected. From the results that I have found, I can use Faraday's Law and turn the figures into coulombs.

I predict that when the concentration of the copper sulphate solution is increased, then the current will also increase. The reason for this follows a well-known theory, the collision theory. The theory tells us that with more particles involved (in this case the higher concentration containing more particles) the more energy you will have. The reason is simple; more particles mean more collision between them, which therefore produces more energy. This then means that there would probably be a higher current because you have more electrons in a more concentrated solution producing more energy, and so the current is then made higher.

I could carry out the experiment in two ways; the first would be to measure the change of mass of the copper. However, this method is very difficult to carry out, the reason for this is, you need to take into account the original mass of the electrodes, and you need to be very accurate on knowing if ALL of the copper has been taken from the electrodes, the reason being because some of it could still be left behind and may be very hard to pick up and see.

The second and easier way, is to measure the current. To read the current, an ammeter is needed, which clearly shows the current in Amps at the points

within a circuit that you need to measure. From the actual readings, I can work out the percentage mass change of the copper. For the simple reason of the second method being much easier, I have chosen to carry out the experiment in that way.

Apparatus:

1. D. C. power supply – for providing the power for the experiment.

2. Ammeter – for measuring the amount of current flowing though the circuit.

3. Electrodes [Anode (+) and Cathode (-)].

4. Circuit wire – for connecting up the apparatus to the power supply.

5. Beaker – for holding copper sulphate solution.

6. Copper sulphate solution – for doing the electrolysis experiment.

7. Glass bridge – this is used to rest the electrodes on

8. Crocodile clips – to put on the wires

9. Measuring cylinder – to measure the different concentrations of copper sulphate solution

10. Copper Sulphate solution

Method:

The experiment contains an impure copper anode, which contains about two percent copper. The whole point of the experiment is to get the copper pure

enough to be used as copper wiring, which has approximately 99. 98 percent pure copper, we need to get the impure copper anode to help make the copper wiring which is so much purer than the anode itself. The purification process begins is at the anode. I predict this because I think that this is where the copper will be deposited, the reason being, electrons are flowing from negative to positive. These electrons get rid of the coppers positive charge, leaving pure copper.

The cathode has a thin sheet of pure copper roughly 99 percent pure. When the current is passed through the electrolysis cell, the copper will pass from the anode to the cathode. This means that the cathode sheet of copper becomes more pure, and at this point becomes roughly 99. 99 percent pure copper, however, the impurities that move from the anode to the cathode drop off and are left at the bottom of the beaker.

Key Variables:

Temperature – temperature may have an affect on the current. The reason is that if the temperature is higher, then the particles will move more quickly thus causing more collisions and producing more energy. On the contrary, less energy is produced.

Concentration – The main point of the experiment is to see how the concentrations affect the current. I will change the concentration after three tries on each one and then move on to the next concentration value. The reason for taking three tries is to make a fair test because this way, there is less chance of making any errors.

Safety:

1. Firstly I will have to wear safety goggles at all times when in the lab while I myself or anyone around me is conducting the same experiment.

2. I must ensure that I am wearing an apron or lab coat which will shield my clothes from any spills of the copper sulphate solution.

3. Just to be careful, I will mix the copper sulphate solution concentrations and measure them out next to or above a sink. The reason being, that I do not want any of the solution spilling on to the electrical equipment, as this may have serious consequences attached to it.

4. Since copper sulphate is an irritant, I will have to be extra careful just to keep all the solutions within their containers.

5. However, if any spills make their way on to my skin then I would be sure to wash it off with water at the nearest tap.

6. I must make sure not to run to get anything or to hurry to wash off any solution, he risks of any more accidents are to great in this situation and therefore I must carefully walk to the nearest tap to wash off the solution.

7. If I spill any solution on someone else then I will be sure to advise them to wash off the spill with water through the same process that I would take.

8. I must remember to wipe off any spill which land on the workplace so that there is no risk of it coming in contact with anyone else.

9. I must make sure that all electrical wiring is organised so that there is not loose wiring which may cause anyone to trip over, so I will have to keep a regular check on the wiring in case it poses a threat to anyone.

Results:

Concentration (Molar)

Test 1 Current (Amps)

Test 2 Current (Amps)

Test 3 Current (Amps)

1

0. 55

0. 55

0. 48

0. 8

0. 29

0. 29

0. 34

0. 6

0. 23

0. 22

0. 24

0. 4

0. 13

0. 17

0. 11

0. 2

0. 08

0. 09

0. 10

0

0

0

0

Now I will have to work out the average current of each concentration using the simple method of working out the mean between the three tests.

Test 1 Current + Test 2 Current + Test 3 Current = n

n/number of tests = AVERAGE CURRENT FOR THAT CONCENTRATION

Concentration (Molar)

Average Current (Amps) (2dp)

1

0. 53

0. 8

0. 31

0. 6

0. 23

0. 4

0. 14

0. 2

0. 09

0

0

Now I need to work out how many moles of electrons there are in coulombs

for each concentration.

Time MULTIPLIED BY Current Quantity of Electrons

Quantity of Electricity DIVIDED BY 96000 Moles of electrons

This is how I will work out the Moles of electrons for each concentration.

Concentration (Molar)

Quantity of Electricity / C

Moles of Electrons / C

1

63. 6

0. 0006625

0. 8

37. 2

0. 0003875

0. 6

27. 6

0. 0002875

0. 4

16. 8

0. 000175

0. 2

10. 8

0. 0001125

0

0

0

Analysis and Conclusion:

In this experiment I have found that when the concentration of the copper sulphate solution is changed, then the current will be affected and therefore will also change. This means that the Quantity of Electricity and the Moles of Electrons will also differ as an affect of the change of concentration, it can be said that this is a chain reaction. Basically, when the concentration is increased (in Molar) then the current will also increase and vice versa. When the concentration is raised and the current increases with it, then the Quantity of Electricity is also increased and so is the Moles of Electrons, the opposite happens of course when the process is reversed.

In conclusion I can say that the current in the electrolysis cell increases as the concentration increases, this is what I stated in my prediction, I said that the increase would be due to the collision theory. The theory is what my prediction was based on, the reason being, the more particles that you have

the more energy that you will have to make the particles move around more. This would mean that the current would increase because the particles are moving around more and producing more energy.

My prediction was correct, and basing it on the collision theory I think that I have done well to understand the electrolysis of copper from copper sulphate solution.

Evaluation:

My results are very satisfactory and I am impressed with the results that I have obtained while working in the conditions that I did with the equipment which is not at all comparable with the real thing. We worked with a model version of the real thing, and fortunately it gave me the correct results to work with and understand. The experiment was very hard to conduct and took some time to get to grips with what I had to do to set it up correctly and how to record, understand and in some cases, calculate results with set formulae. I am happy with my results because as the graph will show you, I was able to draw a best fit line very easily. I have taken three sets of results for each concentration value; the reason for this is to reduce the chances of any anomalies or errors in my results, I have taken the three so that I can make an AVERAGE out of them and then use the average as my result to make the experiment fairer. After finishing my experiment I have a lot of confident in my results as I can easily draw the best fit line on the graph and they look logical.

However, I am not saying that my experiment was completely flawless, as I say; this experiment was just to get the outline of what electrolysis in this case is about and its affects and points etc.

I could have improved my experiment if I had done the following:

1. Firstly, the time that I had to do the WHOLE experiment was just sufficient to get results that were valid, however, if I had a longer time to conduct the whole experiment, then I would obviously chose a longer period of time than two minutes which is what I worked within for each test. The reason for having a longer time scale would be so that the electrodes would stay within the solution for a longer time increasing the affects of electrolysis and hopefully even enough to completely finish the electrolysing. I had chosen two minutes because of the time restriction and of course because I had to do THREE tests for each concentration of the copper sulphate solution.

2. The way in which I obtained my different concentrations of copper sulphate solution was through mixing the two together to make the mixture. The solution was made by measuring with the naked eye and manual hand, and pouring in the right amount of each element to balance the solution and get to the right concentration. If the concentrations of the solutions were already made for my use with expert accuracy or if I had top scientific equipment to measure out the solution myself, then obviously the results would be more accurate and the concentrations would be fair for the current change etc.

3. If I had extra time then I would certainly take more repeats, this would reduce the risk of any errors or anomalies and so therefore the experiment as a whole would be more trustworthy and accurate (fair).

4. If only the temperature could be controlled I would be able to have much fairer results, because the temperature can affect the rate at which the electrolysis takes place.

This is basically what I would do if I could to make the experiment as a whole much fairer. However, I do think that the experiment was a success and the right results were obtained.