**Measuring X-Ray fluorescence for unknown samples**

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**Monday Group**

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**Aims and objectives**

The aim of this experiment is to measure the X-ray fluorescence over a range of samples. The objectives to reach this aim will be, to calibrate the instruments using measurements of samples with known fluorescence value. To indicate the nature of the X-ray spectrum inducing the fluorescence and to reveal the atomic number dependant effects.

**Risk assessment**

***Table.1*** (Risk assessment table)

|  |  |
| --- | --- |
| **Hazards** | **Control Measures** |
| X-rays | Do not touch any components within the left hand (source) chamber – that contains the X-ray tube |
| High voltages | Do not attempt to overcome the interlocks |
| Implosion of the glass X-ray tube | Do not use equipment if interlocks are faulty or the shielding is damaged (or you suspect that this might be the case) |
| Handling of sources | Wear gloves when in contact with the sources |

**Apparatus**

For this experiment we will be using the LD X-ray apparatus this contains a goniometer inside the experimental chamber.

**Experimental skills**

These skills will be all most important to make sure that the experiment goes smoothly:

* Safe use of X-rays
* Handling the sample with care
* Experience of software to be able use commercial software and data control to make sure that it’s easy to read
* The ability to use a photo counting X-ray energy detector and a multi-channel analyser
* Modelling of spectroscopic peaks
* The ability to execute the experiment carefully and professionally in a scientific manner

**Experimental section**

**Setting up the equipment**

Switch the LD X-ray apparatus on. On the front panel of the unit select the centre button and turn the adjust dial to 90°s and it is a safe position for the tests. Press U on the front panel and use the adjust dial to set the voltage to 35 kV, which is the maximum of the apparatus. Select I on the front panel and set the current to 1 mA (which is also the maximum available value on the apparatus). Insure the HV (High voltage) indicator located on the bottom of the front panel is turned off and not flashing. When pressing the HV button the doors will be automatically locked and X-rays will be starting to be created. Make sure that the cooling fan for the X-ray tube anode is turned on and working. This should be audible. On your computer set up the CASSY program. In the CASSY program you must use the settings box to set choose the right section on the sensor-CASSY. This then will allow you to set up the measuring parameters. The measuring parameters are ‘512 channels’, gain (-)2.5 and the measuring time to 300 seconds. Ensure the multi-channel measurements and negative pulses check boxes are ticked.

**Calibrating the equipment**

The equipment is calibrated using samples of known fluorescence this ensures the accuracy of the equipment. This will be done by using galvanized steel sample as recommended by the creators of the LD X-rays apparatus. Firstly, we will pick out the galvanised steel from the box of samples, then place the steel inside the LD X-ray apparatus in the experimental chamber. On the front panel of the LD X-ray apparatus select target and use the adjust dial to set the angle to 45°t. Check that the green LED on the X-ray detector is lit. This is done by looking from a eagle view of the LD X-ray apparatus you can see the green LED lighting up next to the word ready. This tells us that the X-ray detector is ready for use. Press the HV button that is at the bottom of the front panel and then press the F9 key on your keyboard for it to start to take in measurements, this will run for 5 minutes (300 seconds). The centre of the first peak was in the channel 102.6 with a value of 6.4. This then means that the second peak centre was over 8.64ev and channel of 133.5. However, there will be an error in our value of +/- 0.03. By then opening the X-ray energies it opens a periodic table and it shows us Zinc is one element in the material as it closely correlates with our second peak and the other element was iron as it correlates without first peak.

**Getting used to the equipment**

To make sure that we understand the equipment and what they do we have decided to run most of the materials inside the LD X-ray apparatus.

**Conclusion for week 1**

We now have a good amount of knowledge about how the LD X-ray apparatus work. Therefore, when we come in next week to finish the experiment, we will know what measurements to put in to be able to calibrate the equipment instantly to get straight in. We know also know that every element will have two different peaks the taller first one being alpha and the second shorter one being beta. However, on alloys the peaks are different elements that have been put together to create that specific element.

**Week 2 experiment**

The experiment we have decided to complete in week 2 is to pick random coins and then to find what exactly those coins are made from using the LD X-ray apparatus and its fluorescence spectrum.

For this week we have had to recalibrate the values for the energy calibration because we changed kit with the other group by mistake leading for the spectrum to change a little bit. Therefore by running on galvanised steel we have seen that the channel number for the first peak was 84.7 and the channel number for the second peak was 114.5.

Firstly, we calibrated the machine and the CASSY program with the same settings and values that we acquired in week 1. Then the first coin we decided to use in the machine is a 50 Euro cent. This then resulted in giving us peaks in the channel of ……………. And energy level of …………. . After this text we decided to then put a united states of America one dime. This then gave us very similar peaks to the 50-euro Cent.