Transmission of X-rays Fluorescence through Vanadium , Chromium and Manganese

S. H. Al-Shamma
Department of Physics – College of Education
Mosul University

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الخلاصة

درست في هذا البحث دراسة الأشعة السينية المتفلورة المنبعثة من سطوح معدنية مختلفة . هيجت هذه السطوح بالخطين المتميزين (Cu-kα1 and Cu-$k_{\beta 1}$) وهى تقابل طاقات الأشعة السينية (8.05 و 8.92) كيلو إلكترون فولت على التوالي . ودرست نفاذية هذه الأشعة من خلال المرشحات فناد يوم ، كروميوم والمنغنيز . ومن خلال هذه الدراسة لوحظ وجود التواء واضح عند منتصف كل منحن . و هذا الالتواء ناشئ من حافة امتصاص الكوبلت .

ABSTRACT

In this paper , the measurements of x-ray fluorescence emitted from different metallic surfaces which have been excited by two distinguished lines Cu-kα1 and Cu-$k_{\beta 1}$. are reported . The transmission has been studied by three filters (Vanadium , Chromium and Manganese) . The transmission curves reveal a kink near the center . This kink is explained as due to the absorption edge of the cobalt .

INTRODUCTION

Probably no subject in all science illustrate better than x-rays the importance to the entire world of research is pure science . X-rays provide us a kind of supper microscope by means of which we can see not only atoms and their arrangement in crystals but also even the interior of atom itself . Although characteristic x-rays

spectra are produced by bombarding the elements with sufficient energetic electrons . Other method such that by bombarding the target with positive ions (high-energy protons and α-particles) are also used (3) . Any method that causes the removal of an electron from one of the inner levels will results in the production of characteristic x-rays spectra (11,12,15) . x-rays photons can be used to excite or eject core electrons the resulting down word transition as the atom return to its ground state will then produce additional x-rays photons of smaller energy . Such spectrum are frequently termed x-rays fluorescent spectra are usually of low intensity but frequently are the best of analyzing the nature of the elements in an unknown samples . Since the discovery of x-rays by Rontgen (1895) there has been an increasing interest in the use of x-rays in many experimental and theoretical research groups (4-14) . A different of detectors have been used in x-rays analysis such as (photographic film , G.M counter , proportional counter , scintillation counter and solid state detector) have been reviewed (8,10,13) .

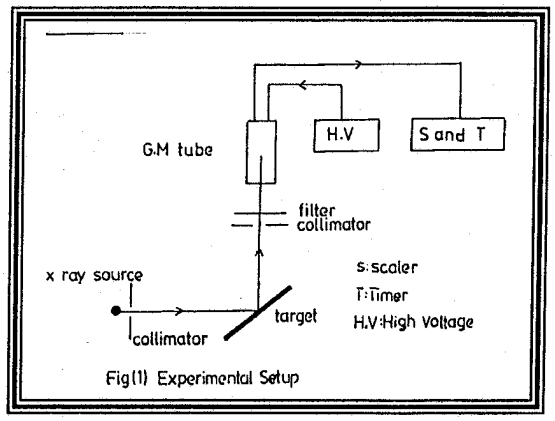
The measurements of the x-rays fluorescent emitted from different metallic surfaces were excited by Cu-k lines . The transmission have been studied through the elements (Co, Ni , Cu and Zn) (1) .

Also , the measurements of the x-rays emitted from poly vinyle butral at different temperatures . The transmission have been studied through different metallic surfaces (2).

In this study , we present the measurement of the x-ray fluorescence emitted from different elements . The transmission have been carried through the elements (V, Cr and Mn) .

EXPERIMENTAL

A schematic diagram of the experimental setup is shown in fig (1) .



Fig(1) Experimental Setup

The apparatus is designed as a horizontal counter tube goniometer with ratable carriage arm and a sample post in the axis of rotation . The angles of rotation of carriage arm and sample post are coupled in a proportion 2:1 . A slide carriage is fitted to the carriage arm . Foils of the elements (V , Cr, Mn , Fe , Ni , Co, Cu and Zn) under study are fixed in the sample post while the filters (V , Cr and Mn) are fitted in slide carriage . X-ray tube consists from high vacuum hot cathod equipped with a copper anode . The maximum current passed through the tube was(0.08 mA) and the applied voltage a cross the tube was (30 kV) .

A time switch maximum two hours switching time permits easy adjustment control of exposure time and prevents in addition uncontrolled continuos operation of the apparatus .

The x-rays after passing the foils that is fixed in a sample post and passing through the filters (V , Cr , and Mn) which are fixed in the rotable carriage is detected by G.M. counter which is fixed behind the filters in the carriage arm .

Finally , is counted by a standard counting electronics as shown in fig (1) . In this study , a suitable check has been made before tacking the measurements that the number of beta particles emitted from the sample are very small and can be neglected . This can be achieved by using foils width equal to the range of beta particles . Thus only x-rays fluorescent is emitted from the sample will pass through .

RESULTS AND DISCUSSIONS

The copper k x-ray spectrum is shown in fig(2) . This spectrum shows kα and k_β peaks are well resolved . In addition this spectrum shows that kα1 peak behavior is guassian more than $k_{\beta 1}$.

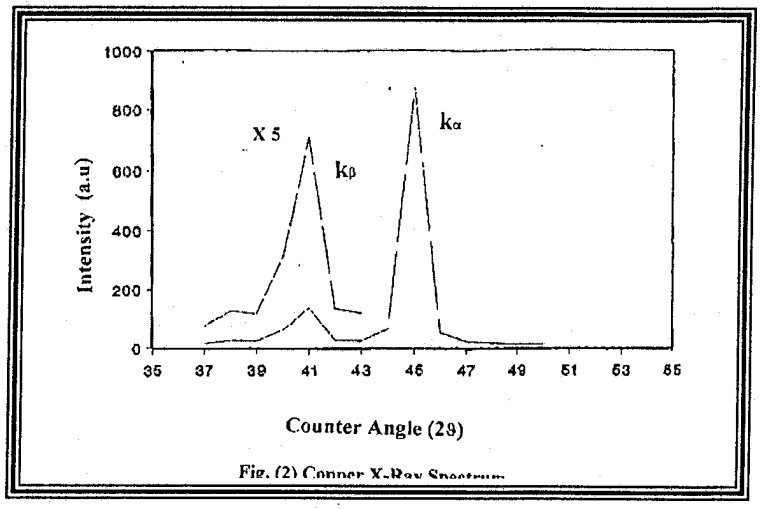


Fig. (2) Copper X-Ray Spectrum

The mass absorption coefficient versus atomic number for two incident x – ray energies (8.05 keV and 8.92 keV) is respectively (16) as shown fig(3) . The XRF intensity emitted from flourescing elements versus atomic number as shown in fig (4) . These elements are (V , Cr , Mn , Fe , Co , Ni , Cu and Zn) with the corresponding atomic number between (24-30) . The detected XRF was taken at 90° with respect to the direction of the incident x-rays . This fig shows that XRF intensity increase with the atomic number (z) . This can be due to increase electron population of z . Also , this curve shows a drop in the XRF intensity at the element Ni (Z= 28) because of the absorption of the incident x-rays in the target element . Finally , the curve seems to be increase due partially absorped because XRF increases with the atomic number of the target . This behavior can be seen clearly in fig (3) .

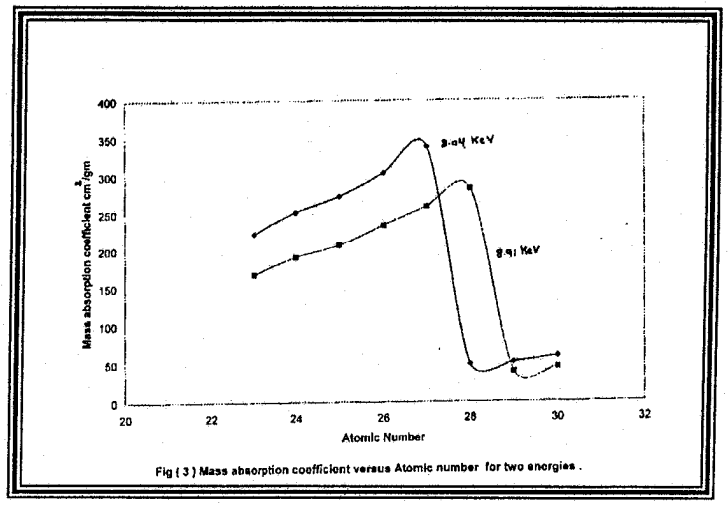


Fig (3) Mass absorption coefficient versus Atomic number for two energies .

The XRF transmission versus atomic weight of the elements is shown in fig (5) . The detection was taken at 90° with respect to the incident x-ray direction (corresponding to the incident energy 0.3 keV) . These measurements have been carried out with the three different filters (V,Cr and Mn). These transmissions show nearly same behavior after A=59 . The XRF transmissions versus atomic weight of the target elements through three different filters (V , Cr and Mn) is shown in figs (6 and 7) .

The target samples were excited by Cu- kα1 and Cu- k β_1 x-rays (correspondind to 8.05 keV and 8.92 keV) . The transmission curves show a kink in the XRF intensity near the center . This can be explained due to the absorption curves increase slowly up to the element Zn. There are no experimental and theoretical data available for comparison .

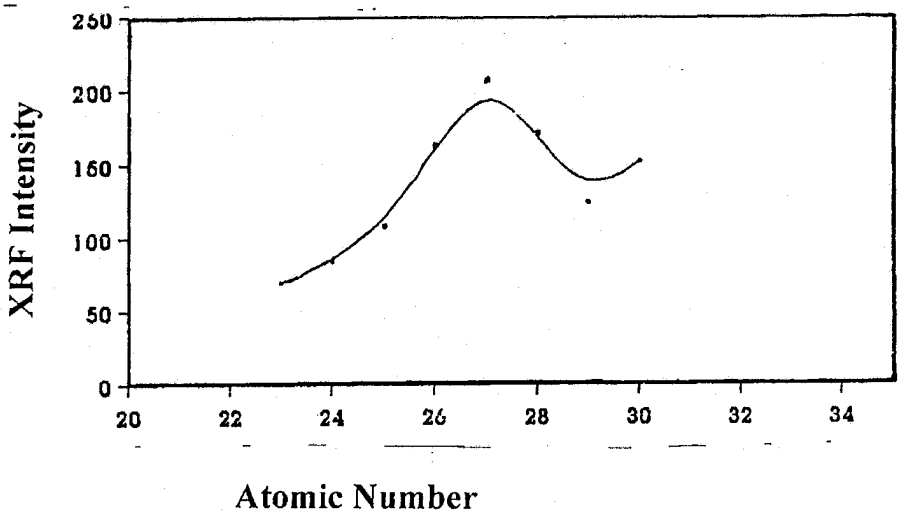


Fig. (4) XRF Intensity *vs* The Atomic Number of The Fluorescing Elements (detection angle = 90°)

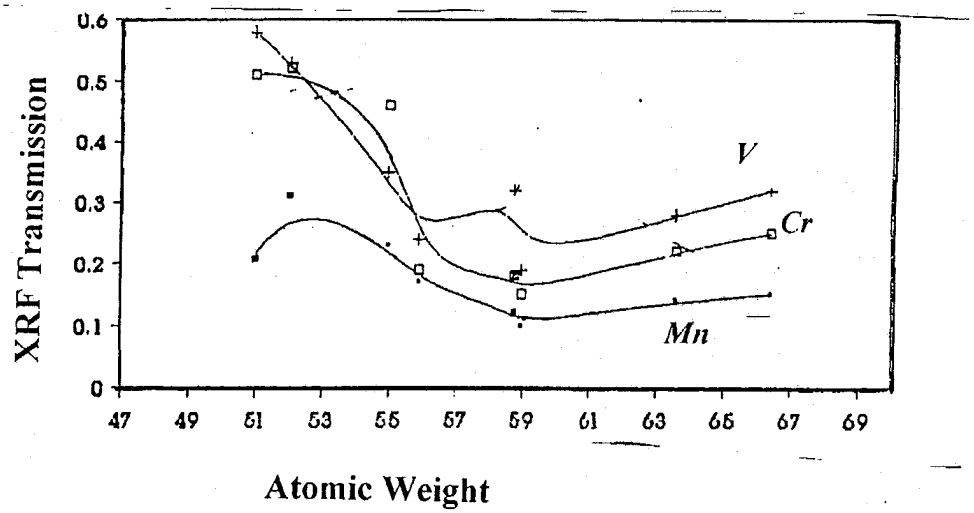


Fig. (5) XRF Transmission *vs* Atomic Weight of the Elements (detection angle = 90°) for a Fixed Filter

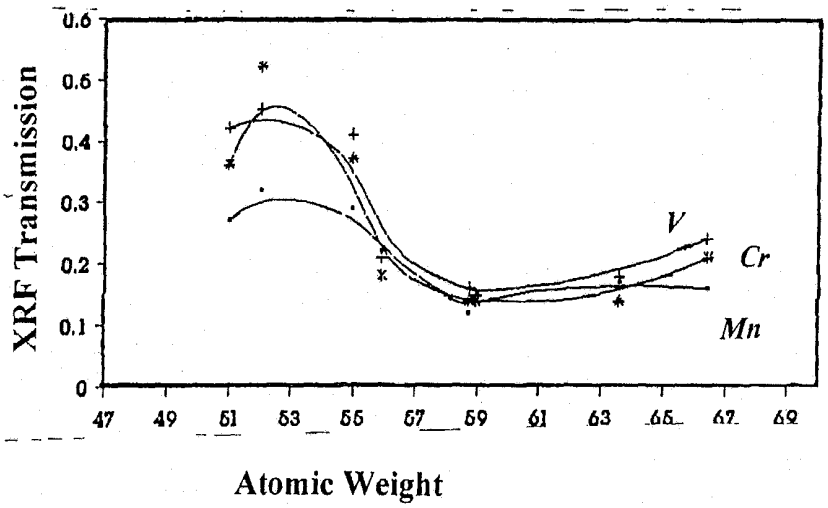


Fig. (6) XRF Transmission *vs* Atomic Weight of the Elements (incident energy = 8.92 keV) for a Fixed Filter

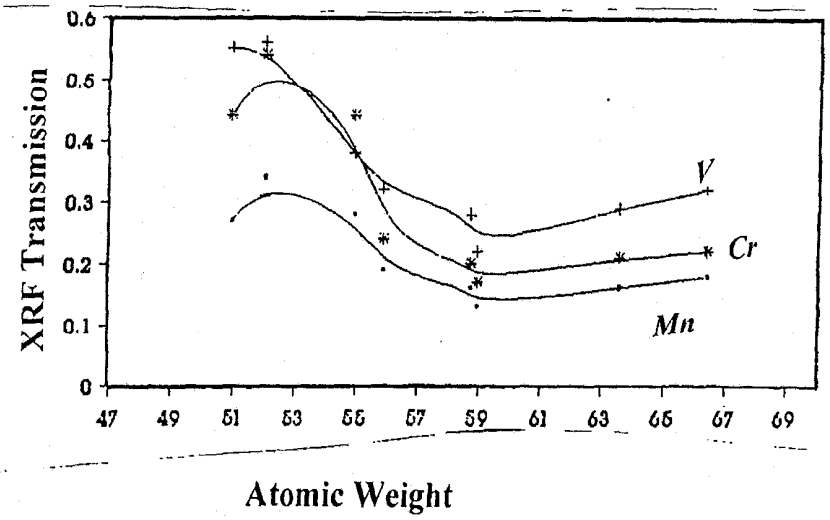


Fig. (7) XRF Transmission *vs* The Atomic Weight of The Elements (incident energy = 8.05 keV) for a fixed Filter

CONCLUSION

Through the study of XRF transmission from the three different metallic surfaces (Vanadium , Chromium and Manganese) , a kink is found near the center . This kink can be explained as due to the absorption of the cobalt . No theoretical and experimental data available for comparison. The XRF technique can be adopted as the best analyzing the absorption spectra of solid .

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