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ABSORPTION COEFFICIENT OF TITANIUM FOR INDUSTRIAL APPLICATIONS

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ABSTRACT

Background: Absorption coefficient explains the intensity decrease of the radiation transient through a material medium. Titanium is the most common metal in the field of material science for identify bio-functional materials.

Methods: Industrial applications such as absorption coefficient and half value layer were measured by the method of intensity relation.

Results: Results show that titanium had highest absorption coefficient compare to composite resin. The shielding material could expect highest absorption coefficient. Absorption coefficient decreases with the effect of thickness of the material enhance. The bio-functional system depends on transport of preparation, environment and types of vigor.

Conclusion: Titanium has play significant role in industrial applications such as implant and energy resources. Titanium could be used in the fabrication of lightweight safety equipment for biomedical, pharmaceutical and industrial devices.

Keywords: Absorption coefficient, half value layer, Titanium, Industrial applications

INTRODUCTION

Interaction of radiation with matter plays major role in the field of science.

Titanium dioxide is the most biomaterial survives in three phases. The appearance of

titanium in material science commence with photo catalytic nature. The general properties become when the size dependence of the nanometer scale. Material can be classified in terms of availability and compatibility. Titanium appears in white color in all kinds of components along with cosmetics. Titanium is non-volatile, stable and insoluble nature. The basic design is to enclose a material sample within a homogenous and isotropic light field. The characterization of the absorption properties of materials is relevant in many regulations. The conventional advance to obtain the coefficient of absorption of a material is to measure the transmittance of a sample confined between smooth parallel faces [1-8].

The major purpose in the selection of titanium, it is used for medical implants and naturally resistant to corrosion. Industrial applications of titanium were calculated by

the method of intensity relation. The properties of substance such as absorption coefficient and half value layer were explored for the titanium. The study of absorption coefficient of different materials have been an important part of investigate in the field of science. While there are several different materials to be used as biological shielding material the titanium dioxide is one of the commonly used material.

METHODOLOGY

Collection of Sample

Titanium dioxide was composed from company: Molychem, Batch No.MCR-13643. All the chemicals used in this study were analytical grade and used without any further refinement. The sample pellets were shown in **Figure 1**. Titanium was made in the form of pellet for the measurement of absorption coefficient.

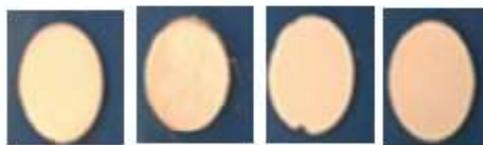


Figure 1: Pellets of the sample

Experiment

The experimental arrangement was made between Geiger-Muller (G.M) counting system shown in **Figure 2**. Situate cobalt-60 gamma source tray at 2cm from the end

window of the G.M. tube. Set the operating voltage (650V) of the G.M. tube. Place the sample between end window detector and source holder of respective thickness. Capture the reading for the period of 600 sec without

any sample and tabulated the experiment by re-cording the data stored for different thickness in the increasing order for the same period of 600 sec. Repeat the same steps as explained above for next sample sets [9].

The absorption coefficient was calculated using intensity relation

$$I(x) = I_0 e^{-\mu x} \quad (1)$$

$$\text{Half value layer} = \frac{\ln(2)}{\mu} \quad (2)$$



Figure 2: G.M. Counting system

RESULTS

Interaction of radiation with matter can be explained in terms of absorption coefficient of the materials. The absorption coefficient has depends upon the type of material and incident radiation. Low absorption coefficient indicates that the sample material has relatively transparent. Absorption coefficient and Half Value Layer of titanium are shown in **Table 1**. Results show that titanium had highest absorption coefficient. The shielding material could expect highest absorption coefficient. The absorption coefficient of the titanium increases by dipping the sample thickness at nano-scale. Titanium could be used in the fabrication of lightweight safety equipment

for biomedical, pharmaceutical and industrial devices.

Comparison of absorption coefficient of composite resin with titanium was shown in **Table 2**. As a result of low absorption coefficient composite resin was reflect on very good biomaterial for shielding of radiation. Biological shielding material has probable to have low absorption coefficient. This type of biomaterial was used for multiple-safety devices and backup safety devices. Absorption coefficient decreases with increase thickness of the material. It indicates that high absorption coefficient communicate to high density material.

Titanium has the lowest half value layer and composite resin has the highest half

value layer. It shows that small thickness of composite resin will be required to attract radiation to half its original intensity. The lowest half value layer of material has the highest absorption capability. Highest half value layer of material has the lowest absorption capability. The significant difference shows that high quality absorber of radiation shielding. Half value layer depends on the intensity of incident radiation and the environment of the material. It means that thickness of titanium increases half value layer increases slowly.

The phenomenon of absorption coefficient indicates the importance of the unique morphology of materials. These materials could be used in the industrial safety equipment. The characteristics of absorption coefficient and half value layer of the material can play the significant role in enhanced radiation shielding capability and long life restorative dental materials. The results give an order of magnitude trends a proposal for future studies. Statistical analysis of the data by means of an ANOVA test between the group was significant difference between the surface micro hardness of these groups $p < 0.05$ [10].

Titanium is highly resistant to chemical attack and has the highest strength to compare any metal. These unique properties

make titanium suitable for a wide range of industrial applications. Biomaterials were used in fiber communication systems. Biomaterials were widely used for temporary restorative function. Biomaterial could be used as a main component in safety instruments such as for protection against radiation sources when opening medical equipment. Biomaterial applications are dental filling composites and orthopedic implants with porous surfaces. The Surprising facts about titanium are twice as strong as aluminum, it is naturally resistant to corrosion and has high melting point.

Absorption coefficient shows significant effects on the chemical, physical and biological properties of biomaterials. Titanium biomaterials were used in fiber communication systems as well as in biomedical field. Biomaterials were widely used for temporary restorative function. Titanium biomaterial could be used as a main component in safety instruments and fabrics used for protection against radiation sources when opening medical equipment. Titanium material can be classified in terms of availability and compatibility. Observations in intensity models for the TiO_2 absorption coefficient for industrial applications were shown in **Figure 3**. Titanium is used in many applications in our day to day life including

energy storage purpose solar batteries design, photovoltaic cell, sensors and electrical activities; biomedical purpose pharmaceutical and cosmetic. Titanium also used in industry

for commercial purpose including paper, rubber, paints, food and wastewater treatment plants.

Table 1: Absorption coefficient and Half Value Layer of titanium

S. No.	Thickness of the Titanium x(cm)	Absorption Coefficient (cm^{-1})	Half Value Layer (cm)
1	0.2	0.83 ± 0.016	0.84 ± 0.041
2	0.4	0.53 ± 0.010	1.32 ± 0.065
3	0.6	0.34 ± 0.006	2.02 ± 0.101
4	0.8	0.23 ± 0.004	3.08 ± 0.154
5	1.0	0.17 ± 0.003	$3.75 \pm 0.1.86$

Table 2: Comparison of absorption coefficient of titanium and Composite resin

S. No.	Thickness of the Titanium x(cm)	Absorption Coefficient of titanium (cm^{-1})	Absorption Coefficient of Composite resin (cm^{-1})
1	0.2	0.83 ± 0.016	0.642 ± 0.012
2	0.4	0.53 ± 0.010	0.423 ± 0.008
3	0.6	0.34 ± 0.006	0.233 ± 0.004
4	0.8	0.23 ± 0.004	0.162 ± 0.003
5	1.0	0.17 ± 0.003	0.052 ± 0.001

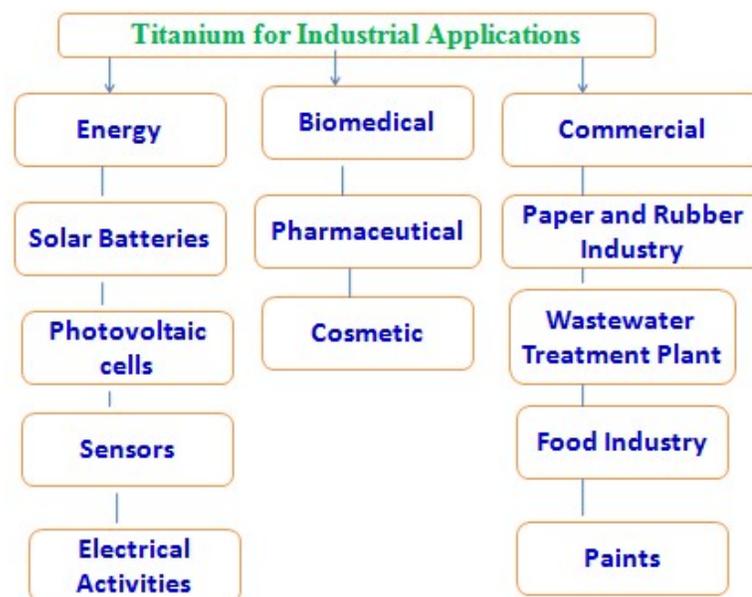


Figure 3: Industrial applications of titanium

DISCUSSION

As one of the most extensively studied photo catalysis material is titanium and widely used in variety of applications in daily life. The studies of absorption coefficient of

titanium materials have been an important part of investigate in the field of science. The random feature selection was employed to titanium system for absorption coefficient. The impact of output data fluctuation has been

investigated. Absorption coefficient shows significant effects on the chemical, physical and biological properties of titanium biomaterials. Titanium dioxide used for orthodontic bands. These observations are now opening new avenues for fabricating lightweight fabric able to offer protection against radiation. Titanium provided much lighter in use weight in comparison with the other current heavy metal base equipment. Composite resin used as primary agent for restorations, and secondary use as temporary restorations [11-12].

Recent studies have shown that titanium photo catalysis degradation efficiency may be affected by various environmental factors in industry. Several different materials to be used as biological shielding material the titanium dioxide is one of the commonly used material. Eggshell waste materials have been widely utilized in biomedical, material synthesis, catalysis. Biomaterials were widely used for temporary restorative function. Biomaterial could be used as a main component in safety instruments and fabrics used for protection against radiation sources when opening medical equipment in biomedical industry. Biomaterial applications are dental filling composites and orthopedic implants with porous surfaces [13-15].

The conventional approach to obtain the coefficient of absorption is to measure the transmittance of a given sample between flat parallel faces. The measurement should be insensitive to titanium sample alignment. Various advanced oxidation processes for textile wastewater treatment have been progressively more applied because of their advantages compared to conventional methods. Titanium has wide band gap and very fast recombination activity has become the focus of recent area of research to develop new materials with preferred characteristics. Titanium forms a very firm surface oxide layer, which is an outstanding corrosion inhibitor [16-19].

Titanium has found a home in numerous industries ranging from power generation to chemical dispensation. In the computer industry titanium is a capable substrate for hard disk drives. The Surprising facts about titanium are twice as strong as aluminum and has high melting point. Titanium has wide applications in energy storage, power generation and very fast recombination activity has become the focus of new area of research to develop materials synthesis with ideal characteristics.

CONCLUSIONS

This work assessed intensity models for the TiO_2 absorption coefficient by

industrial applications. The main conclusions are summarized as follows.

- Key factors affecting photoelectric and stability performance are identified.
- The shielding material could expect highest absorption coefficient.
- Biological shielding material has probable to have low absorption coefficient.
- The absorption coefficient of the titanium increases by dipping the sample thickness at nano-scale.
- The lowest half value layer of material has the highest absorption capability. Highest half value layer of material has the lowest absorption capability.
- Titanium could be used in the fabrication of lightweight safety equipment for biomedical, pharmaceutical and industrial applications.

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Conflict of interest:

The author(s) have no potential conflict of interest.

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