

A PRELIMINARY STUDY ON THE PRODUCTION OF CERAMIC RADIATION SOURCES

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ABSTRACT

The aim of this study is to investigate the possibilities of producing ceramic radiation sources. For this purpose, an uranium compound, uranylacetate powder was mixed with a type of glaze and poured on a ceramic plate so as to form a thin layer on its surface, then heated in the oven to solidify. The counts taken before and after the glazing procedure showed that the glaze material, containing the uranium powder, did not reduce appreciably the amount of radiation reaching the detector, particularly and surprisingly the number of alphas.

ÖZET

Seramik radyasyon kaynaklarının yapılabirliđi konusunda bir inceleme ve bařlangıç niteliđi tařıyan bu alıřmada, bir uranyum bileřiđi olan uranilasetat tozu, sırla karıřtırıldı. Karıřım, seramik bir plaka üzerine ince bir tabaka oluřturacak řekilde döküldü ve fırında katılařıncaya kadar ısıtıldı. Sırlama iřleminden önce ve sonraki saymaların birbirine ok yakın oluřu sırl maddesinin seramik kaynak yapımına olanak sađlıyacađı sonucunu verdi. En ilgin gözlem ise, alfa saymaları arasındaki farkın ihmal edilebilecek düzeyde olması idi.

INTRODUCTION

Radiation sources have been used in numerous radioisotope applications for industrial, scientific, educational and etc. purposes. The sources employed are mostly in metallic form and compared to ceramic types, they may be more costly, more difficult to manufacture and less flexible in shaping according to the application. Therefore, it was thought that a ceramic radiation source could be a good alternative to the metallic one in some applications.

In this preliminary study, a prototype ceramic radiation source was attempted to produce, using uranium as the radioactive material.

MATERIALS AND METHODS

1. Radioactive material

Uranium was chosen as the radioisotope used in the source, because of its availability at the time of the experiment and was in the form of uranylacetate, $(CH_3COO_2) UO_2 \cdot 2H_2O$.

2. Glaze

A brown coloured and high quality type of glaze, the composition of which was known only to its manufacturer* was used to fix the radioactive powder on the surface of a ceramic plate.

3. Heating

An electric oven was utilized to solidify the glaze layer on the ceramic plate, through heating.

4. Counting

For gamma plus beta counting, an LND GM tube No. 7233 and for alpha counting, an EBERLINE scintillator Model RD-13 were used.

EXPERIMENTAL PROCEDURE

Two different amounts of uranylacetate powder with the weights of 0.074 g and 0.234 g were taken and numbered 1 and 2, respectively, and mixed with glaze, then poured on two ceramic plates. Immediately afterwards, they were left in the oven and heated at 1300°C for 1 hr. Following heating and waiting for the samples to cool down to room temperature, counts were taken with the instruments mentioned above.

RESULTS

The counts taken both with the GM tube and the alpha scintillator, before and after the glazing, together with other details, are all given in Table — 1.

TABLE — 1. Summary of the results

Sample No.	Uranylacetate Amount (g)	GM Count per 0.1 min		Alpha Count per 0.1 min		Glaze Layer	
		before	after	before	after	thickness (mm)	area (cm ²)
1	0.074	882 ± 30	860 ± 29	54 ± 7	50 ± 7	1.05	1.3
2	0.126	1563 ± 40	1529 ± 39	96 ± 10	94 ± 10	1.95	3.2

DISCUSSION AND CONCLUSIONS

The results given in Table — 1. have shown that :

- (a) The glaze material, containing the uranium powder, did not reduce appreciably the number of counts read on the counter.

* Arslan Gercik - Arslan Seramik Koll. Şti.

- (b) More importantly, the alpha counts were measured to be almost equal, forming such a speculation that the uranium component of the uranylacetate compound had concentrated on the surface of the glaze, following the glazing and heating.

Testing for contamination was applied to the sources, in that, the sources were wiped with a swab, moistened with alcohol and water; the activity removed was no greater than the background. The testing method employed here was very similar to that used for the Amersham products.

From these observations, one can conclude that a glaze material when mixed with radioisotopes will make the production of ceramic radiation sources possible.

The next step of the work will, naturally, be the examination of different glaze - radioisotope combinations.

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