

Updated database for K-shell fluorescence yields

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Updated Database for K-Shell Fluorescence Yields

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Abstract. This study presents a summary of experimental data of K-shell fluorescence yields (ω_K) published in the period of time between 2010 to february-2017. The fluorescence yields (ω_K) of elements in the range $23 \leq Z \leq 60$ taken directly from different sources were reviewed and presented in a table form. Finally, the experimental and empirical values in the literature have been reported and commented.

INTRODUCTION

The increasing application of X-ray fluorescence in various fields such as industry, agriculture, archaeology, forensic science, etc. requires accurate knowledge of X-ray fluorescence parameters. The fluorescence yield is one of these important parameters. The K-shell fluorescence yield of an atom is defined as the probability that a vacancy in the K-shell is the ratio filled through a radiative transition. At the present time, although several papers have been made about K-shell fluorescence yields in the literature, reviewed K-shell fluorescence yields have been made little. The experimental and empirical K-shell fluorescence yields have been reported by different authors. Kahoul et al. (2012) was reviewed K-shell fluorescence yields in the literature from 1994 to 2011 and was reported new empirical values. Aylikcı et al. (2014) have been performed the semi-empirical and empirical calculations of K-shell fluorescence yields for the elements having the atomic numbers between $21 \leq Z \leq 30$. Akman (2016) was measured experimental values of the K-shell fluorescence yields for some elements in the atomic range $30 \leq Z \leq 58$ using EDXRF. Also, the K-shell fluorescence yields of some elements the atomic numbers between $24 \leq Z \leq 48$ were measured using a Si(Li) detector by Söğüt (2010). Horakeri et al. (2011) measured the K-shell fluorescence yields of barium and lanthanum using a simple 2π geometrical configuration method.

In this paper, the experimental and empirical K-shell fluorescence yields values of elements in the range $23 \leq Z \leq 60$ that reported in the literature from 2010 to february-2017 were reviewed. Finally, the obtained results were presented in a tabular form and commented.

DATA ANALYSIS

We have calculated Unweighted average value ($\bar{\omega}$) and reviewed in a table form the K-shell fluorescence yields. The Unweighted average value is

$$\bar{\omega} = \frac{\sum_{i=1}^N \omega_i}{N} \quad (1)$$

where ω_i is the experimental fluorescence yields and N is the number of experimental data.

Table1. K-shell fluorescence yields (ω_K) and Unweighted average value ($\bar{\omega}_W$) for some elements.

Z	ω_K	$\bar{\omega}_W$	References
23, V	0.239±0.049	0.2481	Kahoul et al. (2012)
23, V	0.246		Daoudi and Kahoul (2015)
23, V	0.246		Ménesguen and Lépy (2010)
23, V	0.264±0.013		Aylikci et al. (2014)
23, V	0.249±0.256		Palmeri et al. (2012)
23, V	0.245± 0.099	Dogan et al. (2013)	
24, Cr	0.265±0.026	0.2819	Söğüt (2010)
24, Cr	0.271±0.044		Kahoul et al. (2012)
24, Cr	0.27760		Daoudi and Kahoul (2015)
24, Cr	0.267±0.006		Yılmaz (2014)
24, Cr	0.275±0.014		Demir and Şahin (2013)
24, Cr	0.299±0.015		Aylikci et al. (2014)
24, Cr	0.294±0.289		Palmeri et al. (2012)
24, Cr	0.283±0.008		Mirji et al. (2015)
24, Cr	0.312		Kaçal et al. (2015)
24, Cr	0.275± 0.115		Dogan et al. (2013)
25, Mn	0.297±0.030	0.3154	Söğüt (2010)
25, Mn	0.303±0.002		Kahoul et al. (2012)
25, Mn	0.3103		Daoudi and Kahoul (2015)
25, Mn	0.311±0.007		Yılmaz (2014)
25, Mn	0.343±0.017		Demir and Şahin (2013)
25, Mn	0.334±0.017		Aylikci et al. (2014)
25, Mn	0.320±0.321		Palmeri et al. (2012)
25, Mn	0.305± 0.087		Dogan et al. (2013)
26, Fe	0.366±0.033	0.3529	Söğüt (2010)
26, Fe	0.335±0.061		Kahoul et al. (2012)
26, Fe	0.3433		Daoudi and Kahoul (2015)
26, Fe	0.333±0.006		Yılmaz (2014)
26, Fe	0.351±0.018		Demir and Şahin (2013)
26, Fe	0.368±0.018		Aylikci et al. (2014)
26, Fe	0.375		Kaçal et al. (2015)
26, Fe	0.336± 0.076		Dogan et al. (2013)
27, Co	0.366±0.018		0.3788
27, Co	0.391±0.039	Söğüt (2010)	
27, Co	0.368±0.037	Kahoul et al. (2012)	
27, Co	0.376	Daoudi and Kahoul (2015)	
27, Co	0.379±0.008	Yılmaz (2014)	
27, Co	0.380±0.020	Demir and Şahin (2013)	
27, Co	0.403±0.021	Aylikci et al. (2014)	
27, Co	0.388	Kaçal et al. (2015)	
27, Co	0.368±0.388	Palmeri et al. (2012)	
27, Co	0.369± 0.109	Dogan et al. (2013)	
28, Ni	0.451±0.045	0.4204	Söğüt (2010)
28, Ni	0.400±0.014		Kahoul et al. (2012)
28, Ni	0.409		Daoudi and Kahoul (2015)
28, Ni	0.416±0.022		Demir and Şahin (2013)
28, Ni	0.437±0.022		Aylikci et al. (2014)
28, Ni	0.427		Kaçal et al. (2015)
28, Ni	0.403± 0.098		Dogan et al. (2013)

Table 1 (Cont). K-shell fluorescence yields (ω_K) and Unweighted average value ($\bar{\omega}_W$) for some elements.

Z	ω_K	$\bar{\omega}_W$	References
29, Cu	0.478±0.047	0.4103	Söğüt (2010)
29, Cu	0.432±0.011		Kahoul et al. (2012)
29, Cu	0.442		Daoudi and Kahoul (2015)
29, Cu	0.456±0.028		Yilmaz et al. (2015)
29, Cu	0.454±0.023		Demir and Şahin (2013)
29, Cu	0.437		Ménesguen and Lépy (2010)
29, Cu	0.442±0.454		Palmeri et al. (2012)
29, Cu	0.422		Kaçal et al. (2015)
29, Cu	0.456±0.009		Mirji et al. (2015)
29, Cu	0.438± 0.071		Dogan et al. (2013)
30, Zn	0.485±0.024	0.4865	Aylikci et al. (2010)
30, Zn	0.525±0.050		Söğüt (2010)
30, Zn	0.463±0.117		Kahoul et al. (2012)
30, Zn	0.473		Daoudi and Kahoul (2015)
30, Zn	0.485		Castelerio et al. (2010)
30, Zn	0.487±0.025		Demir and Şahin (2013)
30, Zn	0.495		Ménesguen and Lépy (2010)
30, Zn	0.486±0.022		Akman (2016)
30, Zn	0.499±0.025		Aylikci et al. (2014)
30, Zn	0.481±0.469		Palmeri et al. (2012)
30, Zn	0.485		Sampaio et al. (2016)
30, Zn	0.474± 0.047		Dogan et al. (2013)
30, Zn	0.487±0.009		Mirji et al. (2015)
31, Ga	0.493±0.027	0.5000	Kahoul et al. (2012)
31, Ga	0.504		Daoudi and Kahoul (2015)
31, Ga	0.503±0.017		Akman (2016)
32, Ge	0.523±0.034	0.5320	Kahoul et al. (2012)
32, Ge	0.534		Daoudi and Kahoul (2015)
32, Ge	0.528±0.030		Yilmaz et al. (2015)
32, Ge	0.522±0.020		Akman (2016)
32, Ge	0.553±0.013		Sampaio et al. (2014)
33, As	0.551±0.052	0.5600	Kahoul et al. (2012)
33, As	0.563		Daoudi and Kahoul (2015)
33, As	0.552±0.032		Yilmaz et al. (2015)
33, As	0.574±0.030		Demir and Şahin (2013)
34, Se	0.578±0.011	0.5963	Kahoul et al. (2012)
34, Se	0.590		Daoudi and Kahoul (2015)
34, Se	0.610±0.032		Demir and Şahin (2013)
35, Br	0.604±0.046	0.6070	Kahoul et al. (2012)
35, Br	0.616		Daoudi and Kahoul (2015)
35, Br	0.601±0.029		Yilmaz et al. (2015)
37, Rb	0.652±0.009	0.6557	Kahoul et al. (2012)
37, Rb	0.664		Daoudi and Kahoul (2015)
37, Rb	0.651±0.033		Yilmaz et al. (2015)

Table 1 (Cont). K-shell fluorescence yields (ω_K) and Unweighted average value ($\bar{\omega}_W$) for some elements.

Z	ω_K	$\bar{\omega}_W$	References
38, Sr	0.675±0.003	0.6907	Kahoul et al. (2012)
38, Sr	0.687		Daoudi and Kahoul (2015)
38, Sr	0.710±0.037		Demir and Şahin (2013)
39, Yr	0.696±0.006	0.7160	Kahoul et al. (2012)
39, Yr	0.708		Daoudi and Kahoul (2015)
39, Yr	0.723±0.038		Demir and Şahin (2013)
39, Yr	0.737±0.031		Akman (2016)
40, Zr	0.716±0.024	0.7224	Kahoul et al. (2012)
40, Zr	0.727		Daoudi and Kahoul (2015)
40, Zr	0.733±0.038		Demir and Şahin (2013)
40, Zr	0.705±0.027		Akman (2016)
40, Zr	0.730		Onder et al. (2013)
41, Nb	0.734±0.012	0.7480	Kahoul et al. (2012)
41, Nb	0.746		Daoudi and Kahoul (2015)
41, Nb	0.738±0.038		Demir and Şahin (2013)
41, Nb	0.773±0.028		Akman (2016)
41, Nb	0.747		Onder et al. (2013)
42, Mo	0.752±0.093	0.7690	Kahoul et al. (2012)
42, Mo	0.763		Daoudi and Kahoul (2015)
42, Mo	0.770±0.040		Demir and Şahin (2013)
42, Mo	0.795±0.028		Akman (2016)
42, Mo	0.765		Onder et al. (2013)
47, Ag	0.835		Daoudi and Kahoul (2015)
47, Ag	0.829±0.043		Demir and Şahin (2013)
47, Ag	0.811±0.024		Akman (2016)
47, Ag	0.831		Onder et al. (2013)
48, Cd	0.738±0.058		0.7238
48, Cd	0.838±0.006	Kahoul et al. (2012)	
48, Cd	0.846	Daoudi and Kahoul (2015)	
48, Cd	0.842	Castelerio et al. (2010)	
48, Cd	0.842±0.044	Demir and Şahin (2013)	
48, Cd	0.837±0.025	Akman (2016)	
48, Cd	0.847	Onder et al. (2013)	
48, Cd	0.842	Sampaio et al. (2016)	
49, In	0.850±0.004	0.8510	Kahoul et al. (2012)
49, In	0.857		Daoudi and Kahoul (2015)
49, In	0.843±0.044		Demir and Şahin (2013)
49, In	0.854±0.026		Akman (2016)
50, Sn	0.860±0.011		0.8610
50, Sn	0.867	Daoudi and Kahoul (2015)	
50, Sn	0.856±0.045	Demir and Şahin (2013)	
50, Sn	0.863±0.027	Akman (2016)	

Table 1 (Cont). K-shell fluorescence yields (ω_K) and Unweighted average value ($\bar{\omega}_W$) for some elements.

Z	ω_K	$\bar{\omega}_W$	References
50, Sn	0.859		Onder et al. (2013)
51, Sb	0.880±0.031	0.8745	Kahoul et al. (2012)
51, Sb	0.846		Daoudi and Kahoul (2015)
51, Sb	0.862±0.045		Demir and Şahin (2013)
51, Sb	0.910±0.029		Akman (2016)
52, Te	0.884±0.021	0.8105	Kahoul et al. (2012)
52, Te	0.865		Daoudi and Kahoul (2015)
52, Te	0.874±0.045		Demir and Şahin (2013)
52, Te	0.919±0.029		Akman (2016)
55, Cs	0.904		Daoudi and Kahoul (2015)
55, Cs	0.869±0.027		Akman (2016)
56, Ba	0.888±0.008	0.9031	Horakeri et al. (2011)
56, Ba	0.901±0.008		Kahoul et al. (2012)
56, Ba	0.913		Daoudi and Kahoul (2015)
56, Ba	0.945±0.034		Akman et al. (2016)
56, Ba	0.897±0.047		Demir and Şahin (2013)
56, Ba	0.876±0.029		Akman (2016)
56, Ba	0.902		Madeira et al. (2015)
57, La	0.911±0.010	0.8614	Horakeri et al. (2011)
57, La	0.905±0.013		Kahoul et al. (2012)
57, La	0.920		Daoudi and Kahoul (2015)
57, La	0.904±0.037		Akman et al. (2016)
57, La	0.910±0.047		Demir and Şahin (2013)
57, La	0.878±0.031		Akman (2016)
57, La	0.902±0.051		Akman (2016)
58, Ce	0.909±0.004	0.9176	Kahoul et al. (2012)
58, Ce	0.92556		Daoudi and Kahoul (2015)
58, Ce	0.947±0.034		Akman et al. (2016)
58, Ce	0.916±0.048		Demir and Şahin (2013)

Table 1 (Cont). K-shell fluorescence yields (ω_K) and Unweighted average value ($\bar{\omega}$) for some elements.

Z	ω_K	$\bar{\omega}$	References
58, Ce	0.894±0.029		Akman (2016)
58, Ce	0.919±0.041		Akman (2016)
58, Ce	0.912±0.021		Turşucu and Demir (2013)
59, Pr	0.931	0.8375	Daoudi and Kahoul (2015)
59, Pr	0.912±0.018		Kahoul et al. (2012)
59, Pr	0.892±0.041		Akman (2016)
59, Pr	0.915±0.001		Kahoul et al. (2012)
60, Nd	0.935	0.9350	Daoudi and Kahoul (2015)
60, Nd	0.935±0.055		Akman (2016)

CONCLUSION

The reviewed K-shell fluorescence yields and calculated unweighted average values have given Table 1. This study is covering the period 2010 to 2017 and elements in the atomic region $23 \leq Z \leq 60$. All of the obtained results were given Table 1. As seen Table 1, the most studied elements for K-shell fluorescence yields values in the referenced articles are V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ba, La, Ce, Ag and Cd.

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