

電子源の仕事関数

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## 電子源の仕事関数

Possibility of the Schottky emitter with low work function surface

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2018/3/1 第16回真空ナノエレクトロニクスシンポジウム





Purpose	
We have tried to study the reducing work function mechanism and to search materials better than Zr oxide.	
<ul> <li>In this research,</li> <li>We measured the work function of W(100) modified by group III, IV metal oxide by using</li> <li>1. FEM (field emission microscope)</li> <li>2. Retarding method</li> <li>3. PEEM (photoemission electron microscope)</li> </ul>	e)
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			Table 1	P value		
	Pair		Electro-negativity (Pauling)	Ionic radius (nm)	P value	
	Sc	-0	1.36	0.075	0.442	
	Y	-0	1.22	0.090	0.511	
	La	-0	1.10	0.103	0.564	
	Ce	-0	1.12	0.087	0.517	
Group III	Pr	-0	1.13	0.099	0.547	
Group III	Nd	-0	1.14	0.098	0.543	
	Sm	-O	1.17	0.096	0.531	Lanthanoid
	Tb	-0	1.10	0.092	0.539	
	Er	-O	1.24	0.089	0.499	
	Yb	-O	1.10	0.087	0.495	
	Lu	-O	1.27	0.086	0.486	
	Th	-0	1.30	0.094	0.492	
~	Ti	-0	1.54	0.086	0.429	Actinoid
Group IV	Zr	-0	1.33	0.072	0.439	
	Hf	-0	1.30	0.071	0.447	















ri	me	ental resu	ults (4)					
M	(4)	) т	able 2 W	ork funct	tion (FEM	)		
		Electro-negativity	Ionic radius		w w	ork function	(eV)	
Pair		(Pauling)	(nm)	P value	FEM	Retarding	PEEM	
Sc	-0	1.36	0.075	0.442	2.7			
Y	-0	1.22	0.090	0.511	2.0~3.1			
La	-0	1.10	0.103	0.564	2.5, 2.9~3.3			
Ce	-0	1.12	0.087	0.517	2.9~3.1			
Pr	-0	1.13	0.099	0.547	2.5			noi
Nd	-0	1.14	0.098	0.543	2.5			tha
Sm	-0	1.17	0.096	0.531	3.4			an l
	-0	1.10	0.092	0.539	X			
Er VL	-0	1.24	0.089	0.499	2.4	•		_
10	-0	1.10	0.087	0.493	26			- <sub>7</sub>
Lu Th	-0	1.2/	0.080	0.480	2.0			noi
Ti	-0	1.50	0.094	0.492	4 57			- Veti
Zr	-0	1.31	0.072	0.439	2.7~2.9			_ `
Hf	-0	1.30	0.071	0.447	2., 2.,			
	Pair Pair Sc Y La Ce Pr Nd Sm Tb Er Yb Lu Th Ti Zr Hf	Pair           Sc         -O           Y         -O           La         -O           Y         -O           La         -O           Sm         -O           Sm         -O           Sm         -O           Er         -O           Th         -O           Th         -O           Tr         -O           Hf         -O	$\begin{array}{c c} Frimental results of the second state of the second state$	$ \begin{array}{c c} \mbox{reimental results (4)} \\ \mbox{M (4)} \\ \hline \mbox{Table 2 W} \\ \hline \mbox{Pair} & \hline \mbox{Electro-negativity} & \hline \mbox{Ionic radius} \\ \hline \mbox{(Pauling)} & \hline \mbox{Ionic radius} \\ \hline \mbox{Ionic radius} & \hline Ionic r$	$\begin{array}{c c} \mbox{rrimental results (4)} \\ \mbox{M (4)} \\ \hline \\ Table 2 Work function of the formula of the fo$	$\begin{array}{c c} \mbox{reimental results (4)} \\ \mbox{M (4)} \\ \hline Table 2 Work function (FEM) \\ \hline Pair & Electro-negativity (nm) & P value & W \\ \hline FEM & W \\ \hline (Pauling) & Onic radius (nm) & P value & W \\ \hline FEM & W \\ \hline Sc & O & 1.36 & 0.075 & 0.442 & 2.7 \\ \hline Y & O & 1.22 & 0.090 & 0.511 & 2.0 \\ \hline X & O & 1.10 & 0.103 & 0.564 & 2.5, 2.9 \\ \hline X & O & 1.10 & 0.0087 & 0.517 & 2.9 \\ \hline X & O & 1.11 & 0.098 & 0.543 & 2.5 \\ \hline Nd & O & 1.14 & 0.098 & 0.543 & 2.5 \\ \hline Nd & O & 1.14 & 0.098 & 0.543 & 2.5 \\ \hline Nd & O & 1.10 & 0.002 & 0.539 & \times \\ \hline Er & O & 1.24 & 0.089 & 0.499 & 2.4 \\ \hline Yb & O & 1.10 & 0.087 & 0.495 \\ \hline Lu & O & 1.27 & 0.086 & 0.486 & 2.6 \\ \hline Th & O & 1.54 & 0.086 & 0.429 & 4.57 \\ \hline Zr & O & 1.33 & 0.072 & 0.439 & 2.7 \\ \hline Ti & O & 1.30 & 0.071 & 0.447 \\ \hline \end{array}$	$\begin{array}{c c} \mbox{reimental results (4)} \\ \mbox{M (4)} \\ \hline Table 2 Work function (FEM) \\ \hline \mbox{Pair} & Fext{ Factor of the function (mm)} & \begin{tabular}{ c c c c c c c } \hline \mbox{Point} & \begin{tabular}{ c c c c c } \hline \mbox{Fext} & \begin{tabular}{ c c c c } \hline \mbox{Fext} & \begin{tabular}{ c c c c } \hline \mbox{Fext} & \begin{tabular}{ c c c c } \hline \mbox{Fext} & \begin{tabular}{ c c c } \hline \mbox{Fext} & \begin{tabular}{ c c } \hline \mbox{Fext} & \be$	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $











3. Expe	eri	me	ental resu	ılts (5)	)				
3.2 Re	tar	dir	ng method	(2)	1.6	· (D )	1. 4	1)	
			1	able 3 w	ork funct	ion (Retar	aing meth	oa)	_
	Pair		Electro-negativity	Ionic radius	P value	W	ork function (e	eV)	
	1 an		(Pauling)	(nm)	i value	FEM	Retarding	PEEM	
	Sc	-0	1.36	0.075	0.442	2.7			
	Y	-0	1.22	0.090	0.511	2.0~3.1	2.2		_
	La	-0	1.10	0.103	0.564	2.5, 2.9~3.3			4
с Ш	Ce	-0	1.12	0.087	0.517	2.9~3.1	2.5.2	-	
Group III	Pr	-0	1.13	0.099	0.547	2.5	2.7, 3.6		- iou
	Na	-0	1.14	0.098	0.543	2.5			tha
	Sm Th	-0	1.1/	0.096	0.531	3.4			Lar
	10 En	-0	1.10	0.092	0.339	24			-
	Er Vh	-0	1.24	0.089	0.499	2.4			-
	10 Lu	0	1.10	0.087	0.495	26			- p
	Th	-0	1.27	0.080	0.480	2.0			iou
	Ti	-0	1.50	0.094	0.429	4 57			Acti
Group IV	Zr	-0	1.33	0.072	0.439	2.7~2.9			~
	Hf	-0	1.30	0.071	0.447				
									-







3. Expe	eri	me	ental resu	ults (7)					•
3.3 PE	EN	А (	(2) T	able 4 W	ork funct	ion (PEE)	M)		
	n :		Electro-negativity	Ionic radius	<b>D</b> 1	W	ork function (e	eV)	
	Pair		(Pauling)	(nm)	P value	FEM	Retarding	PEEM	
	Sc	-0	1.36	0.075	0.442	2.7		2.5	
	Y	-0	1.22	0.090	0.511	2.0~3.1	2.2	2.7~2.8	
	La	-0	1.10	0.103	0.564	2.5, 2.9~3.3		2.87~2.90	
	Ce	-0	1.12	0.087	0.517	2.9~3.1		2.44~2.50	-
Group III	Pr	-0	1.13	0.099	0.547	2.5	2.7, 3.6	3.11~3.14	loic
-	Nd	-0	1.14	0.098	0.543	2.5		2.47	har
	Sm	-0	1.17	0.096	0.531	3.4	-	3.34	ant
	Tb	-0	1.10	0.092	0.539	×			Ч
	Er	-0	1.24	0.089	0.499	2.4	-	2.65	
	Yb	-0	1.10	0.087	0.495			3.68	
	Lu	-0	1.27	0.086	0.486	2.6		2.52~2.56	oid
	Th	-0	1.30	0.094	0.492	2.7			ctin
Group IV	Ti	-0	1.54	0.086	0.429	4.57			Ac
Group IV	Zr	-0	1.33	0.072	0.439	2.7~2.9			
	Hf	-0	1.30	0.071	0.447			2.84~2.90	













## 2019/11/7

