Electronic Supporting Information

Single Crystalline Ternary Mixed Metal Oxide 1-Dimensional Nanostructures of Ir_{1-x-y}Ru_xV_yO_2 by Vapour Phase Transport

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Table. S1.

<table>
<thead>
<tr>
<th>$\text{Ir}_{1-x-y}\text{Ru}_x\text{V}_y\text{O}_2$</th>
<th>XRD $\theta$ (degree)</th>
<th>XRD d(110) (Å)</th>
<th>Calculated d(110) (Å)</th>
<th>Error (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{Ir}<em>{0.06}\text{Ru}</em>{0.41}\text{V}_{0.53}\text{O}_2$</td>
<td>27.68</td>
<td>3.223</td>
<td>3.200</td>
<td>0.715</td>
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<tr>
<td>$\text{Ir}<em>{0.10}\text{Ru}</em>{0.36}\text{V}_{0.54}\text{O}_2$</td>
<td>27.78</td>
<td>3.211</td>
<td>3.201</td>
<td>0.333</td>
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<tr>
<td>$\text{Ir}<em>{0.12}\text{Ru}</em>{0.34}\text{V}_{0.54}\text{O}_2$</td>
<td>27.76</td>
<td>3.214</td>
<td>3.202</td>
<td>0.366</td>
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<tr>
<td>$\text{Ir}<em>{0.14}\text{Ru}</em>{0.74}\text{V}_{0.12}\text{O}_2$</td>
<td>28.18</td>
<td>3.167</td>
<td>3.182</td>
<td>0.493</td>
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<tr>
<td>$\text{Ir}<em>{0.23}\text{Ru}</em>{0.34}\text{V}_{0.43}\text{O}_2$</td>
<td>27.78</td>
<td>3.211</td>
<td>3.197</td>
<td>0.446</td>
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<tr>
<td>$\text{Ir}<em>{0.39}\text{Ru}</em>{0.37}\text{V}_{0.24}\text{O}_2$</td>
<td>28.00</td>
<td>3.187</td>
<td>3.190</td>
<td>0.113</td>
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<tr>
<td>$\text{Ir}<em>{0.40}\text{Ru}</em>{0.44}\text{V}_{0.16}\text{O}_2$</td>
<td>28.10</td>
<td>3.175</td>
<td>3.187</td>
<td>0.353</td>
</tr>
</tbody>
</table>

* $d(110)$ for $\text{IrO}_2$ : 3.186 Å, $d(110)$ for $\text{RuO}_2$ : 3.176 Å, $d(110)$ for $\text{VO}_2$ : 3.220 Å
* Copper X-ray Wavelength : 1.5418 pm

Table. S1. The $d$-spacing values for the crystallographic planes of (110) of various compositions of $\text{Ir}_{1-x-y}\text{Ru}_x\text{V}_y\text{O}_2$ ternary mixed metal oxide nanowires from XRD measurements and estimated ones with reference data from JCPDS.
Fig. S1 SEM images of as-grown iridium-ruthenium-vanadium ternary mixed metal oxide nanowires on a Si(001) substrate by a vapour transport process. (a) and (b) $\text{Ir}_{0.06}\text{Ru}_{0.41}\text{V}_{0.53}\text{O}_2$, (c) and (d) $\text{Ir}_{0.10}\text{Ru}_{0.36}\text{V}_{0.54}\text{O}_2$. 
Fig. S2. XRD patterns of Ir$_{1-x-y}$Ru$_x$V$_y$O$_2$ ternary mixed metal oxide nanowires at a variety of compositions.
Fig. S3. (a) The low magnification TEM images and (b) the lattice resolved HRTEM image of a single \( \text{Ir}_{0.06}\text{Ru}_{0.41}\text{V}_{0.53}\text{O}_2 \) ternary mixed metal oxide nanowire. (c) EDS-elemental mapping analysis for Ir(L), Ru(K) and V(K) atoms and (d) EDS spectrum of a single \( \text{Ir}_{0.06}\text{Ru}_{0.41}\text{V}_{0.53}\text{O}_2 \) ternary mixed metal oxide nanowire.
Fig. S4. (a) The low magnification TEM images and (b) the lattice resolved HRTEM image of a single $\text{Ir}_{0.10}\text{Ru}_{0.36}\text{V}_{0.54}\text{O}_2$ ternary mixed metal oxide nanowire. (c) EDS-elemental mapping analysis for Ir(L), Ru(K) and V(K) atoms and (d) EDS spectrum of a single $\text{Ir}_{0.10}\text{Ru}_{0.36}\text{V}_{0.54}\text{O}_2$ ternary mixed metal oxide nanowire.
Fig. S5. (a) The low magnification TEM images and (b) the lattice resolved HRTEM image of a single Ir$_{0.14}$Ru$_{0.74}$V$_{0.12}$O$_2$ ternary mixed metal oxide nanowire. (c) EDS-elemental mapping analysis for Ir(L), Ru(K) and V(K) atoms and (d) EDS spectrum of a single Ir$_{0.14}$Ru$_{0.74}$V$_{0.12}$O$_2$ ternary mixed metal oxide nanowire.
Fig. S6. (a) The low magnification TEM images and (b) the lattice resolved HRTEM image of a single $\text{Ir}_{0.23}\text{Ru}_{0.34}\text{V}_{0.43}\text{O}_2$ ternary mixed metal oxide nanowire. (c) EDS-elemental mapping analysis for Ir(L), Ru(K) and V(K) atoms and (d) EDS spectrum of a single $\text{Ir}_{0.23}\text{Ru}_{0.34}\text{V}_{0.43}\text{O}_2$ ternary mixed metal oxide nanowire.
Fig. S7. (a) The low magnification TEM images and (b) the lattice resolved HRTEM image of a single $\text{Ir}_{0.39}\text{Ru}_{0.37}\text{V}_{0.24}\text{O}_2$ ternary mixed metal oxide nanowire. (c) EDS-elemental mapping analysis for Ir(L), Ru(K) and V(K) atoms and (d) EDS spectrum of a single $\text{Ir}_{0.39}\text{Ru}_{0.37}\text{V}_{0.24}\text{O}_2$ ternary mixed metal oxide nanowire.
Fig. S8. (a) The low magnification TEM images and (b) the lattice resolved HRTEM image of a single \( \text{Ir}_{0.40}\text{Ru}_{0.44}\text{V}_{0.16}\text{O}_2 \) ternary mixed metal oxide nanowire. (c) EDS-elemental mapping analysis for Ir(L), Ru(K) and V(K) atoms and (d) EDS spectrum of a single \( \text{Ir}_{0.40}\text{Ru}_{0.44}\text{V}_{0.16}\text{O}_2 \) ternary mixed metal oxide nanowire.
Fig. S9. X-ray Photoelectron Spectroscopy (XPS) data of Ir$_{0.06}$Ru$_{0.41}$V$_{0.53}$O$_2$ mixed metal oxide nanowires for (a) Ir 4f, (b) Ru 3d, and (c) V 2p.
**Fig. S10.** X-ray Photoelectron Spectroscopy (XPS) data of $\text{Ir}_{0.10}\text{Ru}_{0.36}\text{V}_{0.54}\text{O}_2$ mixed metal oxide nanowires for (a) Ir 4f, (b) Ru 3d, and (c) V 2p.
Fig. S11. X-ray Photoelectron Spectroscopy (XPS) data of Ir$_{0.14}$Ru$_{0.74}$V$_{0.12}$O$_2$ mixed metal oxide nanowires for (a) Ir 4f, (b) Ru 3d, and (c) V 2p.
Fig. S12. X-ray Photoelectron Spectroscopy (XPS) data of Ir$_{0.23}$Ru$_{0.34}$V$_{0.43}$O$_2$ mixed metal oxide nanowires for (a) Ir 4f, (b) Ru 3d, and (c) V 2p.
Fig. S13. X-ray Photoelectron Spectroscopy (XPS) data of \( \text{Ir}_{0.39}\text{Ru}_{0.37}\text{V}_{0.24}\text{O}_2 \) mixed metal oxide nanowires for (a) Ir 4f, (b) Ru 3d, and (c) V 2p.