

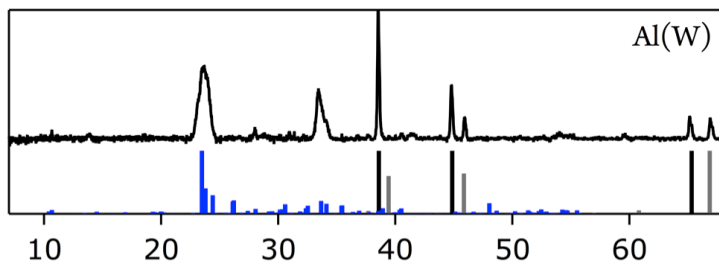
Supporting Information for

Mixed-Metal Tungsten Oxide Photoanode Materials Made by Pulsed-Laser in Liquids Synthesis

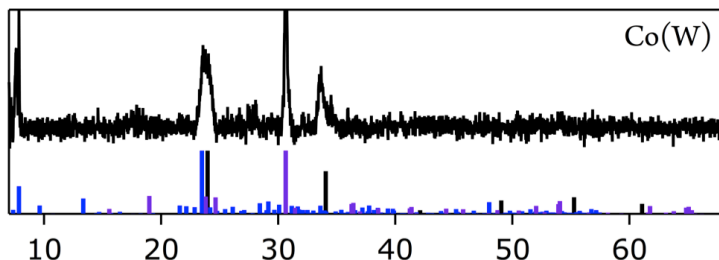
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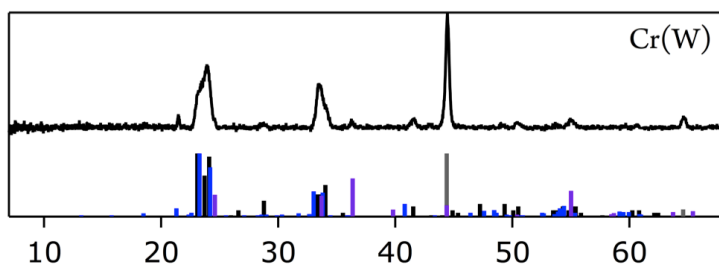
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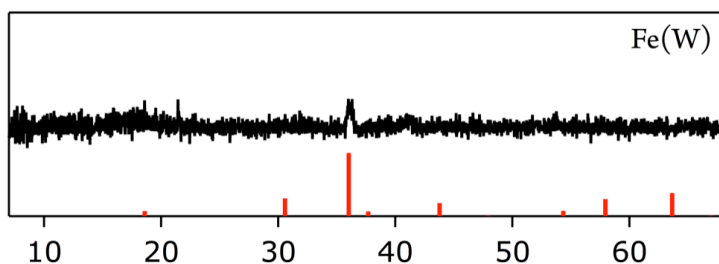
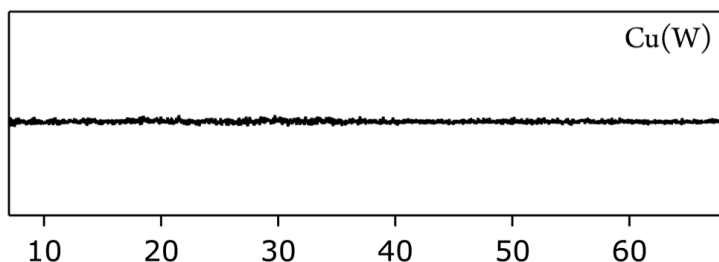
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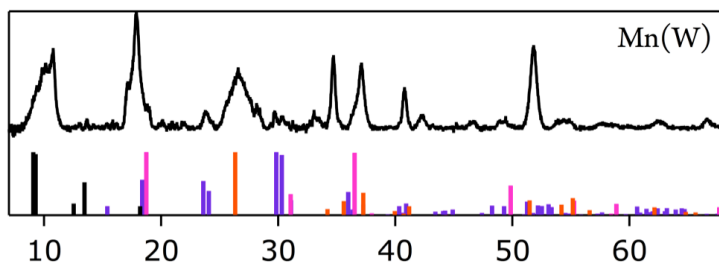
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PDF 01-073-9565, Cr, cubic
 PDF 01-074-1694, $\text{Cr}(\text{WO}_3)_2$, rhombohedral
 PDF 00-020-1324, WO_3 , orthorhombic
 PDF 00-030-1387, $\text{WO}_{2.92}$, monoclinic



PDF 01-076-2950, Fe_3O_4 , cubic



PDF 01-084-1712, $\text{Mn}_6\text{O}_{12}(\text{H}_2\text{O})_{3.16}$, monoclinic
 PDF 01-074-1842, MnOOH , orthorhombic
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2θ (degree)

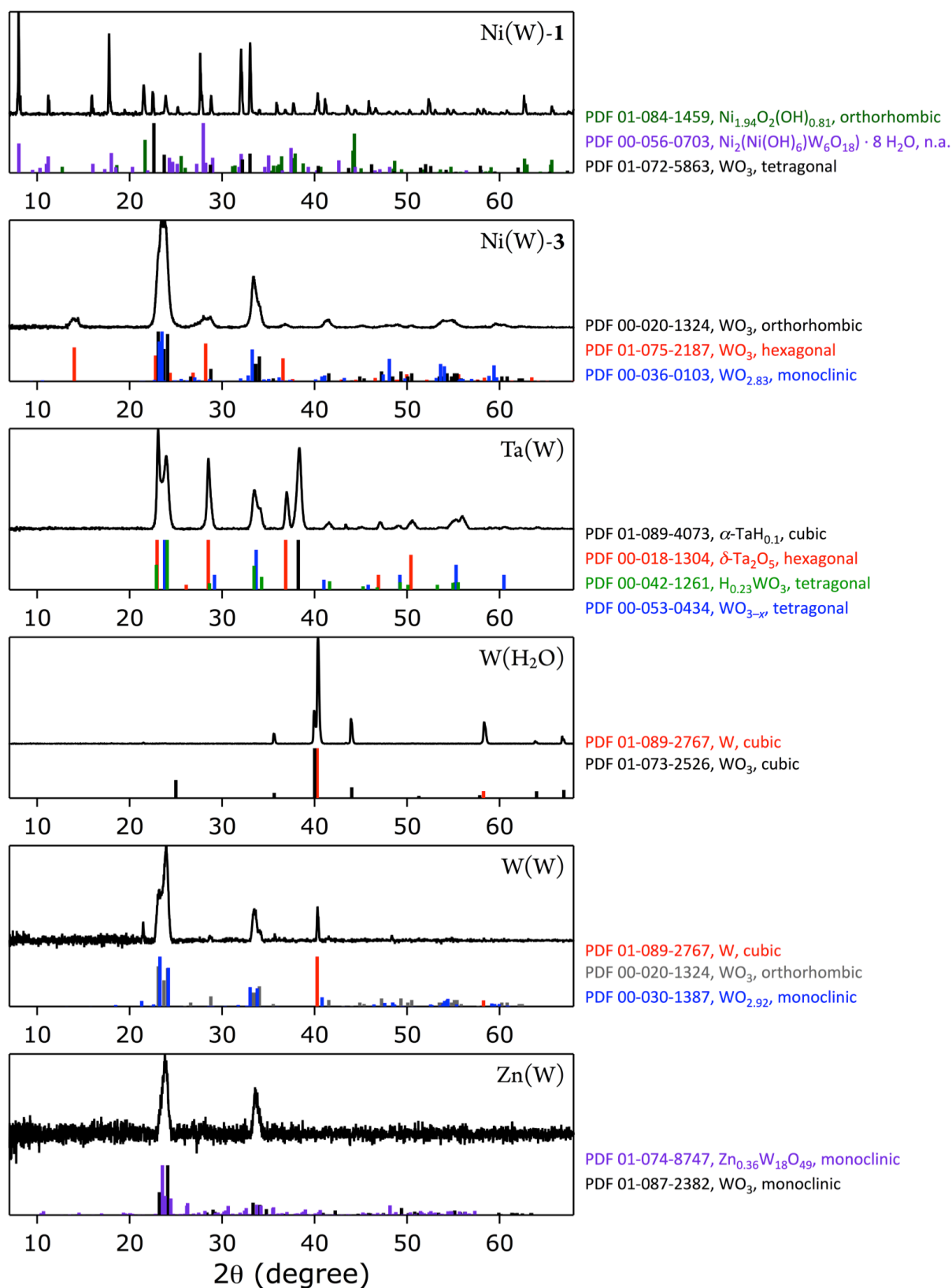


Figure S1. X-ray diffraction (XRD) data of laser-synthesised materials. Black upper, data; sticks to zero, fixed-slit intensities; Powder Diffraction File (PDF) card numbers, chemical formulae, and crystal systems are given on the right (n.a., not assigned). XRD pattern matching was performed with the Bruker DIFFRAC.SUITE software. Details and nomenclature are given in the main text.

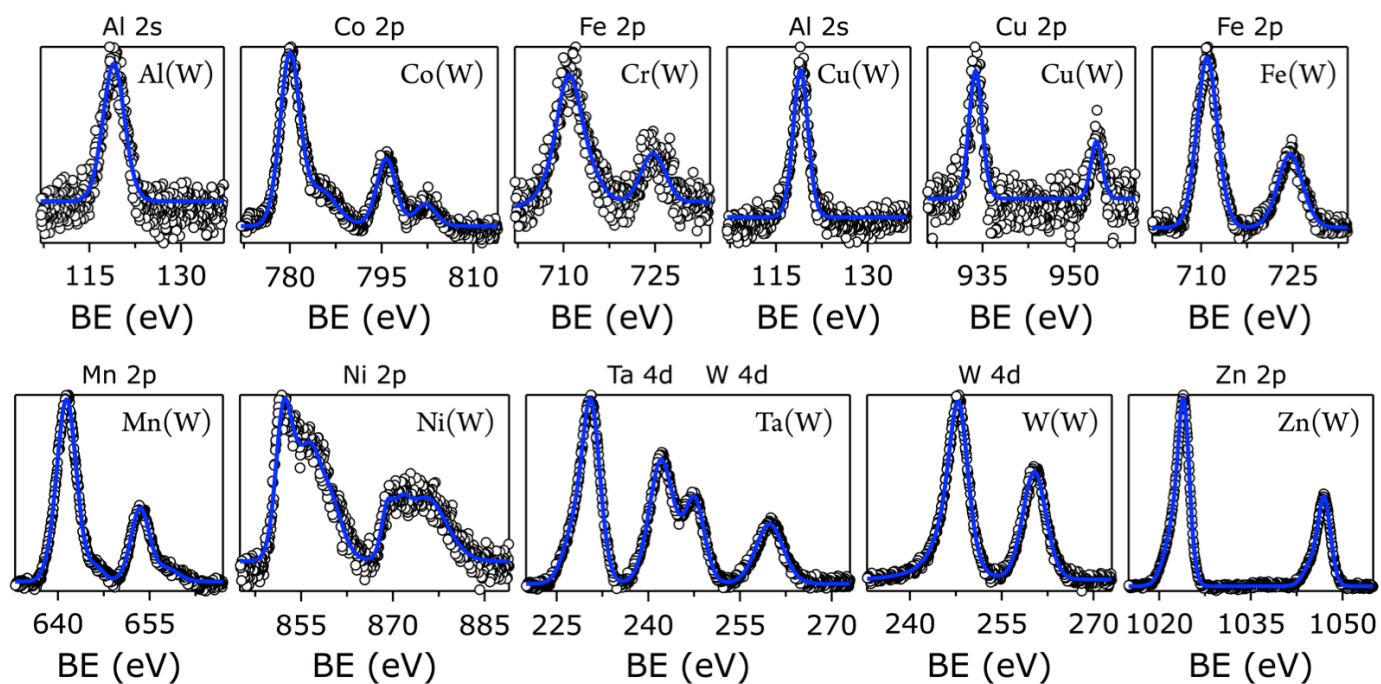


Figure S2. X-ray photoelectron spectra (XPS) of nanomaterials prepared by pulsed-laser synthesis of metals in aqueous ammonium metatungstate solutions; BE, binding energy; open circles, data; blue lines, envelope fits. Details and nomenclature are given in the main text.

Table S1. Central binding energies (CBE) obtained from XPS data and assignments; n.d., not detected. Details and nomenclature are given in the main text.

Material	Line	CBE (eV)	Assignment	Ref
Al(W)	Al 2s	118.9	Al ₂ O ₃	[1]
Co(W)	Co 2p _{3/2}	780.0	Co ²⁺	[2]
Cr(W)	Cr 2p _{3/2}	n.d.		
Cr(W)	Fe 2p _{3/2}	710.9	Fe ²⁺ or Fe ³⁺ (hydr)oxides	[3]
Cu(W)	Cu 2p _{3/2}	933.9	CuO	[4]
Cu(W)	Al 2s	119.0	Al ₂ O ₃	[1]
Fe(W)	Fe 2p _{3/2}	711.0	Fe ²⁺ or Fe ³⁺ (hydr)oxides	[3]
Mn(W)	Mn 2p _{3/2}	641.4	manganese (hydr)oxides	[5]
Ni(W)	Ni 2p _{3/2}	855.7	Ni ³⁺ -O, Ni(OH) ₂	[6]
		854.3	Ni ²⁺ -O	[6a]
		852.0	Ni	[6a]
Ta(W)	Ta 4d _{5/2}	230.6	Ta ₂ O ₅	[7]
		227.1	Ta	[7-8]
W(W)	W 4d _{5/2}	248.0	WO ₃	[8]
		244.0	W	[8]
Zn(W)	Zn 2p _{3/2}	1024.1	ZnO	[9]
		1022.3	Zn-O(H) O _n	[10]

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