Reactivity of Vanadium Oxytrichloride with β-diketones and Diesters as precursors for Vanadium Nitride and Carbide- Supporting Information


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Complex 1 = Dichloro(oxo)(2,4-Pentanedione)
Complex 2 = Synthesis of Dichloro(oxo)(diethyl malonate)
Complex 3 = Dichloro(oxo)(diethyl succinate)
Additional TEM images:

**Figure S1:** TEM images of VN: a) Sample derived from complex 1 with b) showing a \(d\)-spacing of 0.235 nm, assigned as the \(<111>\) plane of VN, c) Sample derived from complex 3 with b) showing a \(d\)-spacing of 0.230 nm, also assigned as the \(<111>\) plane of VN.
Figure S2: TEM images of VC: a) Sample derived from complex 1 with b) showing a $d$-spacing of 0.22 nm, assigned as the $<111>$ plane of VC, c) Sample derived from complex 3 with b) showing a $d$-spacing of 0.23 nm, also assigned as the $<111>$ plane of VC.
Additional EDS data:

Figure S3: EDS spectra of VN: a) Sample derived from complex 1 with c) Sample derived from complex 3 and EDS spectra of VC: b) Sample derived from complex 1 with d) Sample derived from complex 3. Copper emanated from the copper TEM grid.
Additional XRD data:

**Figure S5:** XRD patterns of VN: a) Sample derived from complex 1 with c) Sample derived from complex 3. c) Shows an ICSD standard for VN (No. 22321).
Figure S6: XRD patterns of VC: a) Sample derived from complex 3 with c) Sample derived from complex 1. c) Shows an ICSD standard for VC (No. 159870).
Additional XPS data:

**Figure S6:** V2p XPS spectrum of the VN sample derived from complex 2. Note the three environments of VN (major) as well as vanadium carbide and V$^{5+}$, assigned as V$_2$O$_5$.

**Figure S7:** C1s XPS spectrum of the VC sample derived from complex 2. The environments are assigned as VC, C-O, C-OR and C-C.
Figure S8: XRD patterns of complex 2 annealed at 1000 °C under nitrogen compared to VN ICSD