Supplementary

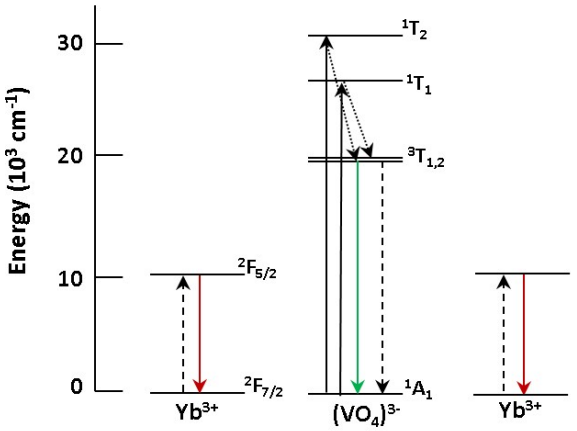

Figure S1: Schematic energy level diagram of $(VO_4)^{3-}$ and Yb^{3+} in $YbVO_4$.[8,20] Black arrows show excitation, while the green and red arrows show emission processes. Relaxation from the $^1T_{1,2}$ excited states to the $^3T_{1,2}$ excited states is most likely non-radiative (short dash). From the $^3T_{1,2}$ excited states, energy can transfer to two nearby Yb^{3+} via CET (dashed arrows). The positions of the energy levels are approximate.

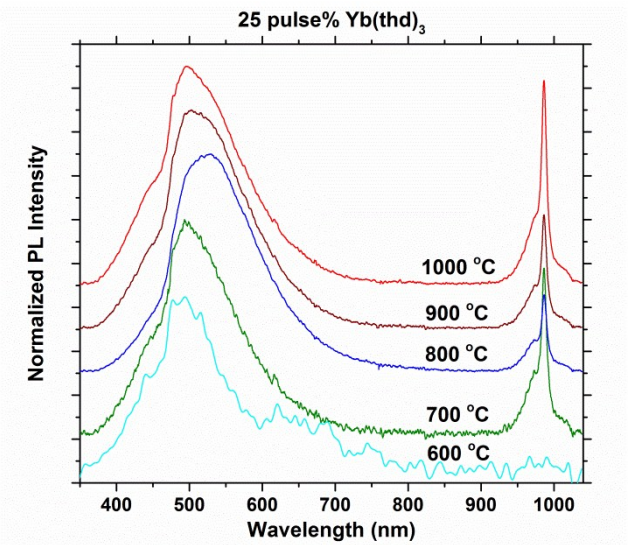

Figure S2: Normalized PL spectra of samples with a 1:3 pulse ratio of $Yb(thd)_3$ and $VO(thd)_2$ annealed at 600-700 °C. Measured with an OceanOptics USB4000 photo spectrometer. No corrections have been made.

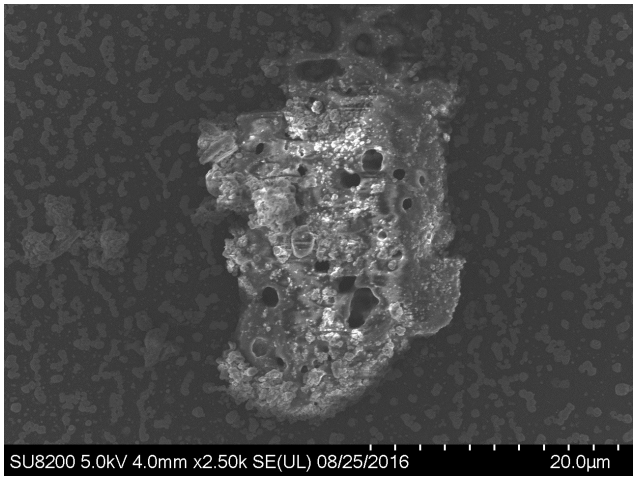

Figure S3: FE-SEM image of a sample with a 1:3 pulse ratio of $Yb(thd)_3$ and $VO(thd)_2$. The amorphous material is expected to consist mostly of excess V_2O_5.

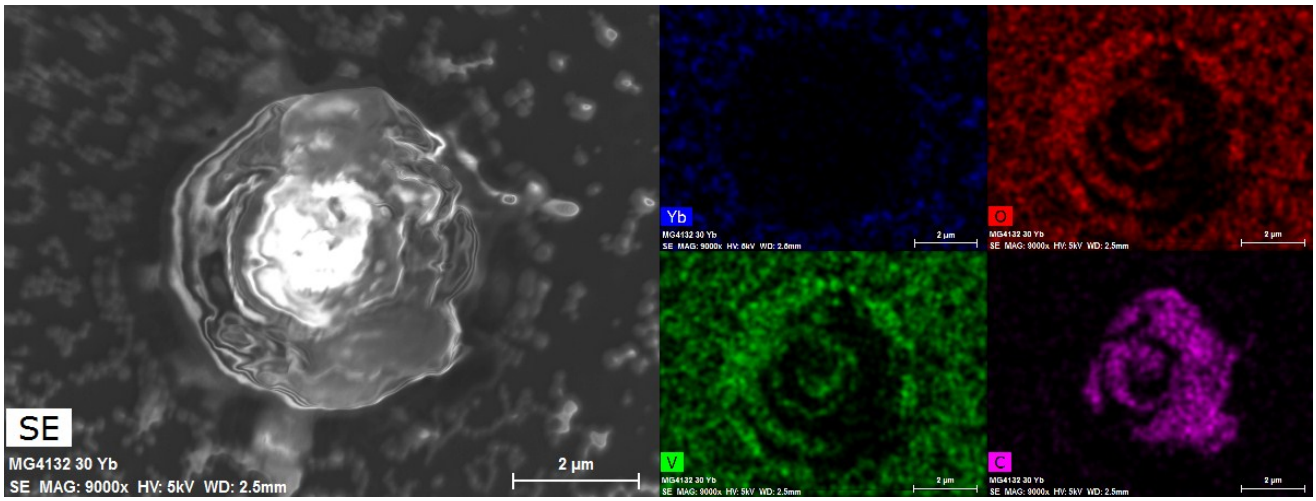

Figure S4: Elemental mapping of a non-crystalline area on a sample with 30 pulse% $Yb(thd)_3$, showing that the amorphous material consists of vanadium, oxygen and carbon and contains no ytterbium.

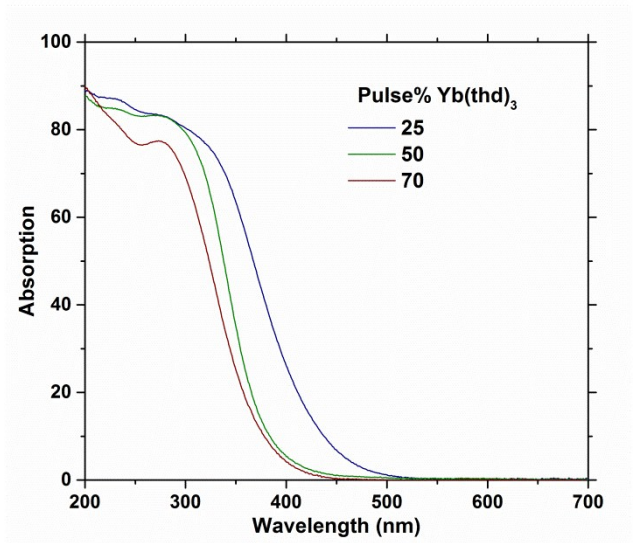

Figure S5: Absorption spectra of some of the as-deposited samples deposited on fused silica. The absorption of the fused silica substrate has not been subtracted.