

Figure S1. XPS spectra covering the Ta 4p core levels. Ta $4p^{3/2}$ has a binding energy of 404 eV which is consistent with Ta (IV).



Figure S2. XPS spectra covering the Ta 4f core levels. Ta $4f^{7/2}$ has a binding energy of 25.5 eV which is consistent with Ta (IV).



Figure S3. Gaussian curves fitted to O 1s data. The green line is molecular oxygen at 533.9 eV and the blue line is ionic oxygen at 531.5 eV. The red line is the overall fit. The ratio of molecular to ionic oxygen is 40:1.



Figure S4. Bright field image of TaS_3 nanoribbon immediately after synthesis and prior to vacuum processing. EDX profile of area 1 indicates that particle is composed entirely of sulfur.



Figure S5. Log-log plot of high resolution UPS spectra close to $E_F.$ The fitted straight line, between 300 and 40 meV, gives α = 0.2 \pm 0.1.