Electronic Supplementary Information

Disordered Microporous Sandia Octahedral Molecular Sieves are Tolerant to Neutron Radiation

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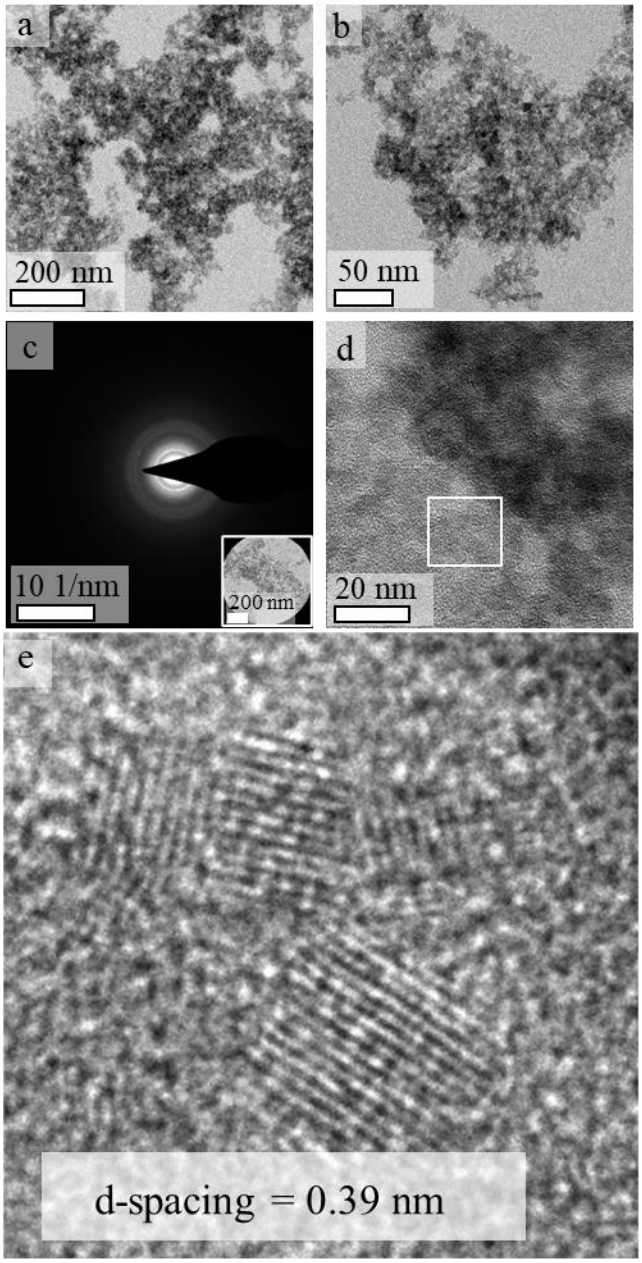

Figure S1. The precursor materials used to prepare Sandia octahedral molecular sieves (SOMS) as characterized by: (a, b) bright field transmission electron microscopy (TEM); (c) selected area electron diffraction (SAED); and (d) high resolution (HR) TEM. A magnified view of the region in (d), indicated by the white box, is shown in (e). This semi-crystalline product had a d-spacing of 0.39 nm, as observed in some of the nanoparticles by HRTEM analyses.

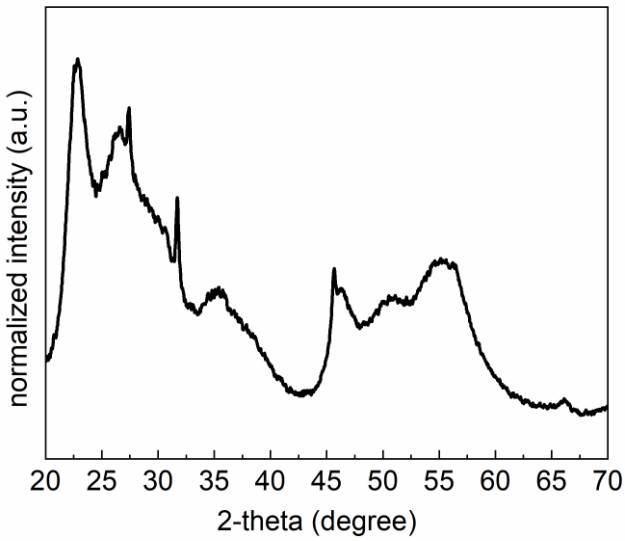

Figure S2. Powder X-ray diffraction (XRD) patterns associated with the precursor used to synthesize nanorods of SOMS through a solution-phase synthesis.

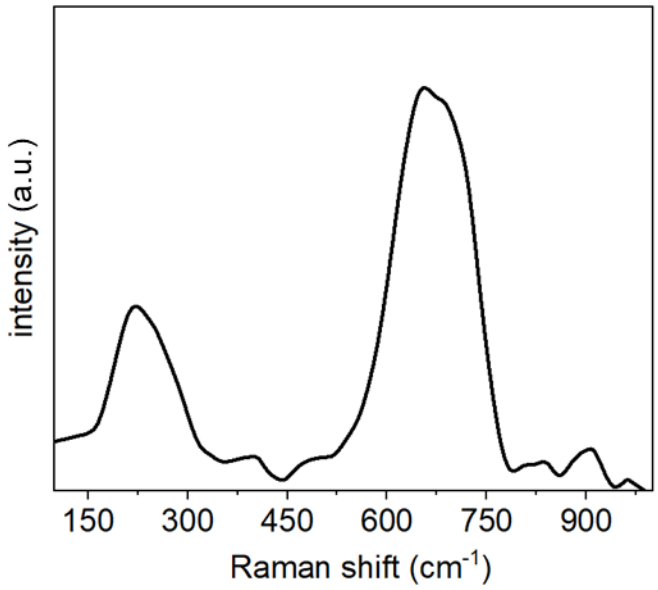

Figure S3. Room temperature Raman spectrum for the precursor material used to prepare the SOMS.

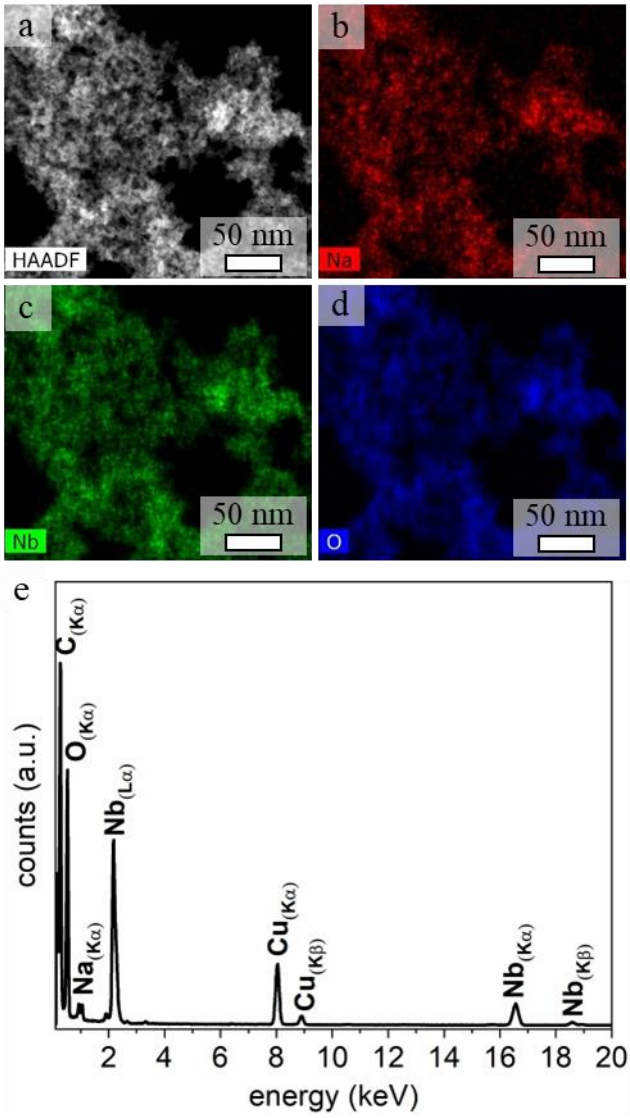

Figure S4. (a) High-angle annular dark-field (HAADF) scanning TEM (STEM) image of the nanoparticles present within the precursor to the SOMS, and corresponding maps of the elements within these materials as obtained by energy dispersed X-ray spectroscopy (EDS) for (b) Na, (c) Nb, and (d) O. (e) An EDS spectrum depicting the average spectral response of these nanomaterials, which further confirms the presence of Na, Nb, and O in this precursor material. The source of the Cu signals in the spectrum was the TEM grid used to support the sample for these analyses.

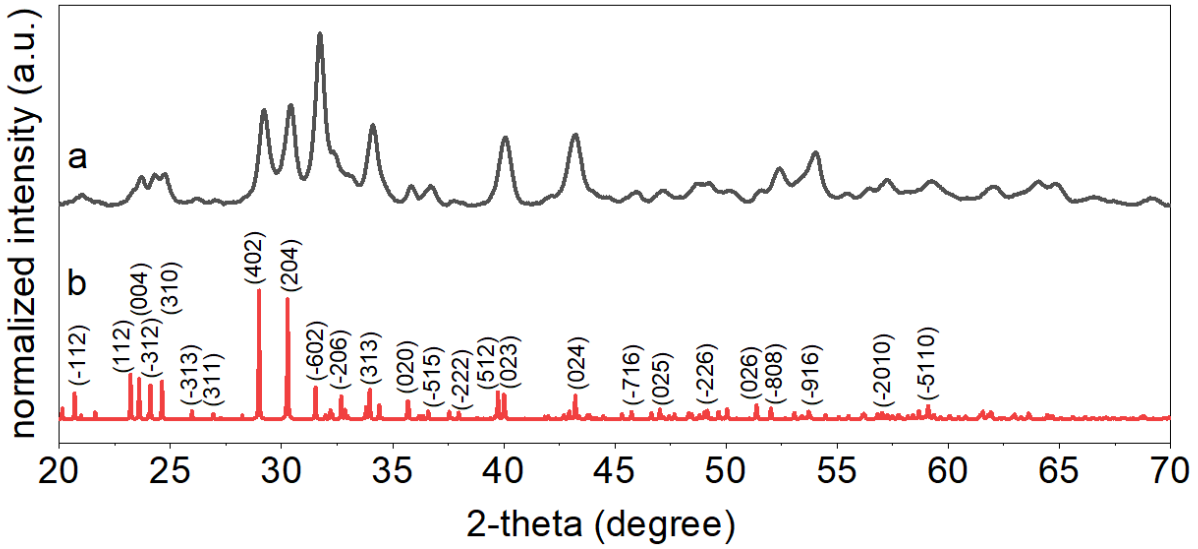

Figure S5. A semi-indexed XRD pattern of (a) SOMS prepared by a solvothermal synthesis and (b) a reported reference sample of $Na_2Nb_2O_6{\cdot}H_2O$ (ICSD No. 55415). The major reflections associated with the products matched those of the reported reference sample.

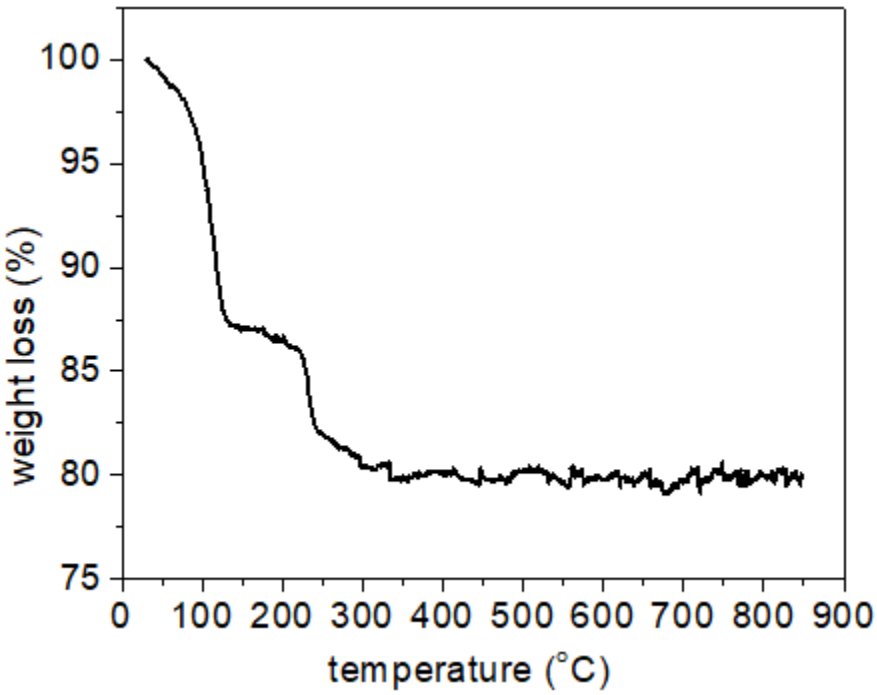

Figure S6. Thermally driven weight loss as obtained from a thermogravimetric analysis (TGA) of the SOMS products prepared by hydrothermal synthesis when heated at a rate of 1 °C/min from 30 to 850 °C under an ambient atmosphere. Following the loss of water from the surfaces and the lattice of the SOMS, these results indicate the relative thermal stability of the product.

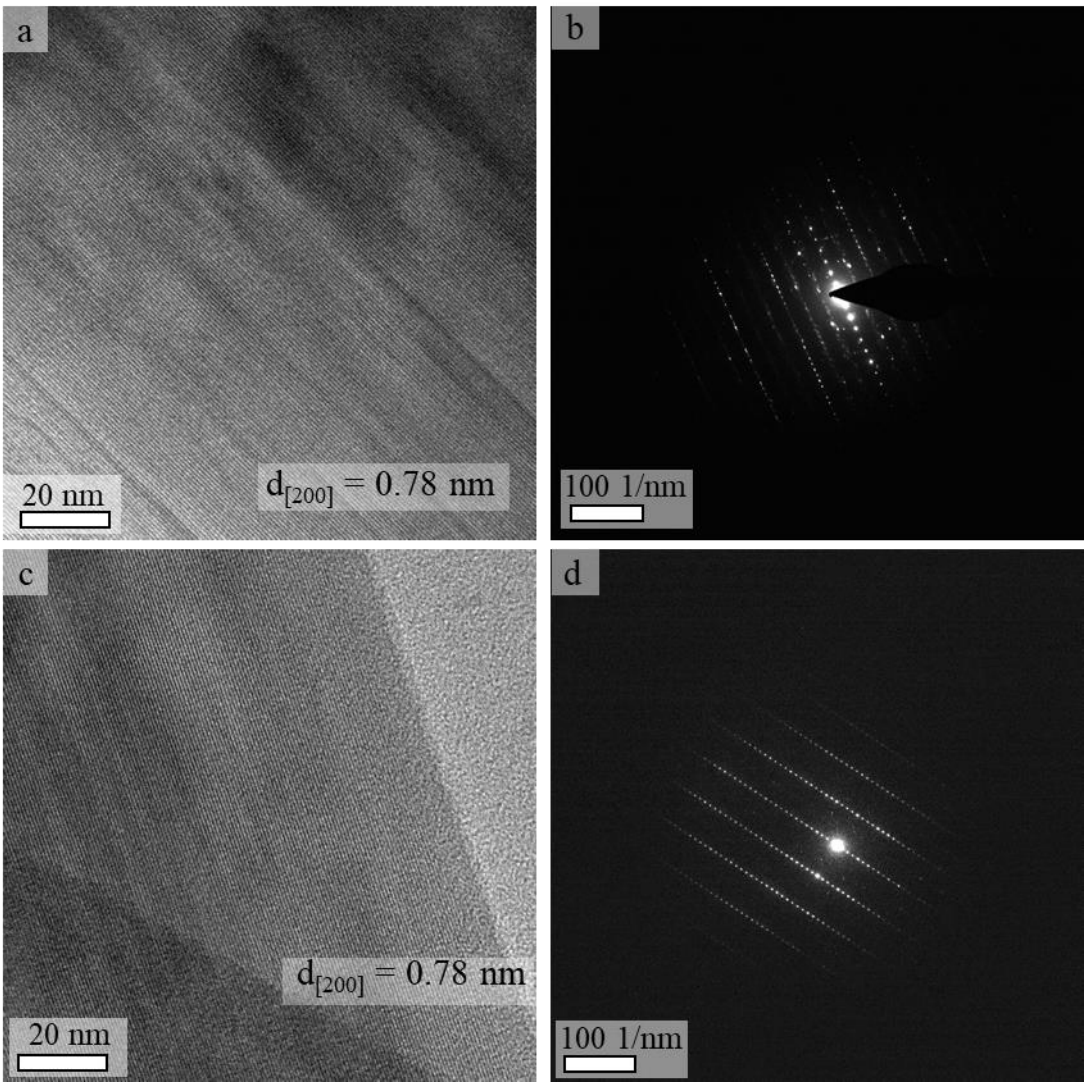

Figure S7. Aberration-corrected HRTEM and SAED analyses at cryogenic temperatures of SOMS-based nanorods: (a,b) before neutron irradiation; and (c,d) after neutron irradiation. These analyses were performed with the assistance of the Facility for Electron Microscopy Research (FEMR) at McGill University using a Thermo Scientific Talos F200X G2 aberration-corrected (S)TEM operated while holding the samples under cryogenic conditions (using a cryo-holder) to minimize potential damage or distortion to the samples from the incident focused electron beam.

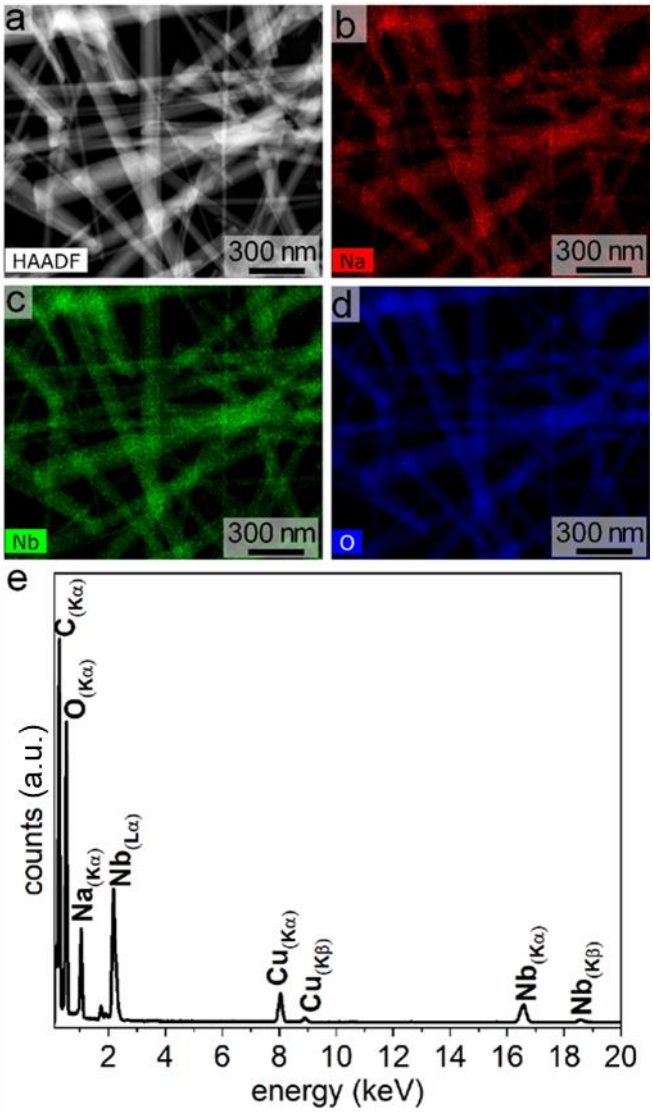

Figure S8. Additional results were obtained by TEM and EDS analyses of SOMS-based nanorods after their exposure to energetic, 14.1 MeV neutrons. (a) A HAADF-based STEM image and corresponding elemental maps obtained by EDS for (b) Na, (c) Nb, and (d) O. (e) An EDS spectrum corresponding to the nominal composition of these nanorods, which further confirmed the presence of Na, Nb and O in the product. The Cu signals in the spectrum originated from the Cu TEM grid used to support the sample during these measurements.

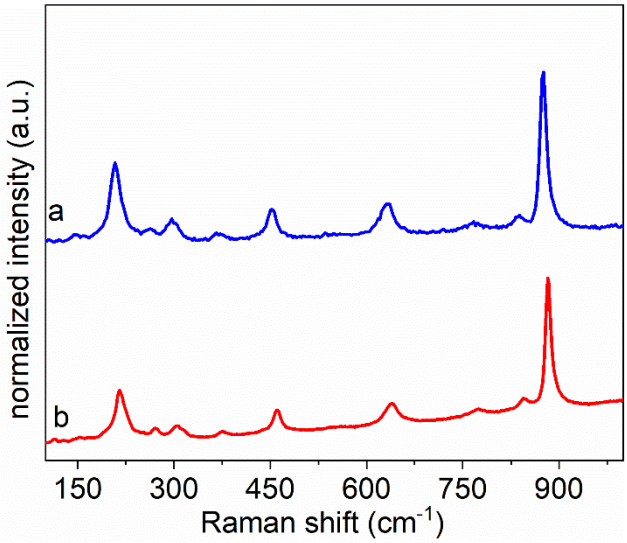

Figure S9. Room temperature Raman spectra obtained from the SOMS-based nanorods both (a) before and (b) after exposure to neutrons for 72 h.