Electronic Supplementary Information (ESI)

Turn Bulks into 0D, 1D and 2D Metallic Nanomaterials by Selective Aqueous Corrosion

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MATERIALS AND METHODS

All the chemical reagents including LiH (97% purity), MgH₂ (95% purity), metal Bi, Ti, Ni, V and Ag (99.9% purity) were purchased from Sigma Aldrich and directly used without purification. The Li_xBi and Mg_xAg alloys were synthesized by the first milling of hydrides and Bi or Ag with different molar ratio at 300 rpm with ball-to-sample weight ratio of 40: 1 for 2 h under an Ar atmosphere, and subsequently sintering at 400 °C for 6 h. The TiNiV alloy was prepared by multiple-step induction sintering according the given molar ratio of Ti, Ni, and V (or VH_x). All the sample handlings were carried out in an Ar-filled glove box with H₂O/O₂ contents less than 1 ppm.

CHARACTERIZATION

To reveal the phase components, X-ray diffraction (XRD) were carried out on a Rigaku D/max 2500 with Cu K_a radiation, a RBD upgraded PHI-5000C ESCA system with Al K_a X-ray source. X-ray photoelectron spectroscopy (XPS) was employed to detect the nanosheets thickness by using a Kratos Axis Ultra X-ray photoelectron spectrometer, equipped with a monochromated aluminum Ka X-ray sources. All these sample handlings including cell assembly were carried out in an Ar-filled glove box. To detect the microstructure and elemental distribution of the nanomaterials, both high-resolution transmission electron microscopy (HRTEM) and scanning electron microscopy (SEM) observations were carried out on a JEOL JEM-2100-F transmission electron microscope and a Shimadzu SUPERSCAN SSX-550 scanning electron microscope that equipped with an energy dispersive X-ray spectrometer (EDX), respectively. Moreover, the high spatial resolution imaging and microanalysis were performed with an FEI Tecnai F20 analytical scanning transmission electron microscope (STEM) equipped with a Fischione high-angle annular dark-field (HAADF) detector and a lithium-drifted silicon X-ray energy-dispersive spectrometer (XEDS). These above HRTEM samples were prepared by dispersion in dried THF solvent, followed by spreading on a holey carbon film supported by a copper grid. To reveal the thickness, AFM was performed on a Veeco NanoScope IIIA AFM instrument in tapping mode that the sample was prepared by directly dispersing Bi NSs powders on 3×3 mm Si substrates.



Fig. S1. XPS spectra (left) and their enlarged regions (right) of Bi 4f bands for the bulk Bi and Bi NSs.



Fig. S2. (a) Topographic AFM image of the Bi NSs, (b) Thickness profiles of the Bi NSs, where the profiles correspond to the cross sections of the dashed line in (a), showing that the average thickness of nanosheets is deemed to be about 3.0 ± 0.4 nm.



Fig. S3. Electrochemical cyclability of the as-prepared Bi NSs at 500 mA g⁻¹ with using LiBH₄ electrolyte at 120 °C, and the room temperature cyclic performance of liquid batteries with LiPF₆ liquid electrolyte is also presented for comparison. Noted that the half-cell is consists of Bi nanosheets|Electrolyte|Li foil, where the solid electrolyte is LiBH₄ and the liquid electrolyte is LiPF₆- containing organic solution.



Fig. S4. TEM image and its schematic Ag particles (black particles) for the hydrolysis products $(Ag + Mg(OH)_2$ as grey matrix) of Mg-Ag composites without acid washing.



Fig. S5. XRD patterns for Ag nanoparticles that were obtained from the Mg-Ag hydrolysis products with acid washing.



Fig. S6. XPS spectra (left) and their enlarged regions (right) of Ag 3*d* bands for the Mg-Ag hydrolysis products and pure Ag NPs.



Fig. S7. TEM images and its elemental mapping for Ag nanoparticles that were obtained from the Mg-Ag hydrolysis products with acid washing.



Fig. S8. SEM image for the eutectic $Ti_{37}Ni_{38}V_{25}$ alloys.



Fig. S9. TEM image for the eutectic $Ti_{37}Ni_{38}V_{25}$ alloys.



Fig. S10. EDX spectrum for the eutectic $Ti_{37}Ni_{38}V_{25}$ alloys in Fig. S5.



Fig. S11. SEM image for the TiNi nanofibers from the eutectic $Ti_{37}Ni_{38}V_{25}$ alloys after removal of V by selected aqueous corrosion.



Fig. S12. EDX spectrum for TiNi nanofibers from the SEM image in Fig. S8 as marked by white circle.



Fig. S13. XPS spectra (upper) and their enlarged regions of (middle) Ti and (bottom) Ni 2*p* bands for the TiNi nanofibers.