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Bottom-Up Wet Chemical Synthesis of Nanostructured Materials from the Infinitely Adaptable Bismuth Telluride Series[1] DANIEL J. VOLPE, JEFFREY S. DYCK, Department of Physics, John Carroll University, PAUL C. CHALLEN, Department of Chemistry, John Carroll University, VIRGIL C. SOLOMON, Department of Mechanical Engineering, Youngstown State University — Novel thermoelectric materials are necessary to solve the looming energy crisis, because they can convert waste heat into usable energy. Bismuth-telluride-based compounds are the focus of this study because of their very good room temperature thermoelectric properties, and they can be prepared in nanostructured forms, which is known to enhance the thermoelectric efficiency. Bismuth telluride nanopowder was synthesized from a bottom-up wet chemical approach with a yield of ˜90%. The starting reagent ratio was tuned to match the desired stoichiometry of the product, thus resulting in the identification phases from an infinitely adaptable series, $(Bi_2)_m(Bi_2Te_3)_n$, where m,n are integer values. Relatively pure Bi_2Te, BiTe and Bi_2Te_3 independent phases were characterized through x-ray diffraction (XRD), scanning electron microscopy (SEM), inductively couple plasma atomic emission spectroscopy (ICP-OES) and energy dispersive x-ray spectroscopy (EDX). Lattice parameters were determined and found to be within 0.45% of literature values of bulk-grown forms for these three compounds.

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