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TITLE

Hybrid tungsten oxide/carbon nanoplatelets and nanorods prepared directly in a flame volume

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We report the rapid single-step flame synthesis of core-shell nanomaterials. Octagonal tungsten-oxide nanoplatelets with controlled aspect ratio and carbon coating overlays are prepared directly in a flame volume. The entire process takes only a few seconds. A high purity tungsten wire inserted into the oxygen-rich region of the flame is used as a material source. The growth of the formed nanostructures begins with the oxidation of the metal probe, and evaporation of the oxide layer which is followed by the transport of the tungsten oxide vapors from the oxygen-rich to the hydrocarbon-rich zone of the flame. In the oxygen-rich zone, tungsten oxide vapors are crystallized into well-defined single crystal octagonal nanoplatelets. The continuous vapor deposition leads to the nanoplatelet growth in a preferred direction resulting in elongated rod-like nanostructures. The surface of the tungsten oxide structures entering the hydrocarbon-rich zone of the flame is coated with carbon layers forming hybrid WO_3/C nanomaterials. The ideal conditions for the rapid and direct formation of these novel nanostructures are attributed to the synergy of the strong thermal and chemical gradients present in the flame volume.

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Biography

Wilson Merchan-Merchan received his Ph.D. from the University of Illinois at Chicago in the areas of Combustion & Nanotechnology in 2005. Currently he holds a faculty position at the University of Oklahoma. One of his areas of research areas focuses on the application of flames for the synthesis of 1-D and 3-D Transition Metal Oxide nano- and micron-sized structures. His work in flame material synthesis has been broadly disseminated by publication in several journals such as Carbon, Chemical Physics Letters, Combustion and Flame, Nanotechnology, among others. Most recently, he has published his work in Carbon, Nanotechnology, Micron, and the Proceeding of the Combustion Institute.

Alexei Saveliev received his B.S. and M.S. degrees in Physics and Engineering and the Ph.D. degree in Chemical Physics and Reacting Flows from the Moscow Institute of Physics and Technology. Prior to joining the North Carolina State University faculty, he spent several years as a Research Professor at the University of Illinois at Chicago (UIC). He has published more than 60 journal papers and co-authored 4 patents.

Moien Farmahini-Farahani is a Ph.D. student of Mechanical Engineering at the University of Oklahoma. His research focuses on flame synthesis of new 1-D and 3-D metal-oxide micro/nanostructures and their functionalization as electrode materials for lithium-ion batteries.