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Production of Energetic Nanomaterials by Spray Flash Evaporation

Authors : Martin Klaumünzer, Jakob Hübner, Denis Spitzer

Abstract : Within this paper, latest results on processing of energetic nanomaterials by means of the Spray Flash Evaporation technique are presented. This technology constitutes a highly effective and continuous way to prepare fascinating materials on the nano- and micro-scale. Within the process, a solution is set under high pressure and sprayed into an evacuated atomization chamber. Subsequent ultrafast evaporation of the solvent leads to an aerosol stream, which is separated by cyclones or filters. No drying gas is required, so the present technique should not be confused with spray dying. Resulting nanothermites, insensitive explosives or propellants and compositions are foreseen to replace toxic (according to REACH) and very sensitive matter in military and civil applications. Diverse examples are given in detail: nano-RDX (n-Cyclotrimethylentrinitramin) and nano-aluminum based systems, mixtures (n-RDX/n-TNT - trinitrotoluene) or even cocrystalline matter like n-CL-20/HMX (Hexanitrohexaazaisowurtzitane/ Cyclotetra-methylentetranitramin). These nanomaterials show reduced sensitivity by trend without losing effectiveness and performance. An analytical study for material characterization was performed by using Atomic Force Microscopy, X-Ray Diffraction, and combined techniques as well as spectroscopic methods. As a matter of course, sensitivity tests regarding electrostatic discharge, impact, and friction are provided.

Keywords : continuous synthesis, energetic material, nanoscale, nanoexplosive, nanothermite
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