Pilot plant production of Thorium Dioxide nanofibers

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Despite the fact that nowadays almost all ceramic materials were successfully prepared in form of nanofibers, actinoid oxides like uranium and thorium oxides are still not described in that form. For the first time we have prepared ThO_2 nanofibers with relatively high surface area. Our work is based on three different approaches: laboratory electrospinning from needle, needleless pilot plant electrospinning (Nanospider LAB500S) and pilot plant electrospinning from charged wire (Nanospider Production Line NS 1WS500U). Various solutions with two different precursors ($Th(NO_3)_4$ and $Th(acac)_4$) were used. Methods were focused on use of the simplest possible ways to obtain ultrafine fibers. Work with nitrate were done in aqueous system and acetylacetonate complex were used in organic solvent system. All methods were developed according the needs of used machinery, where roller needleless system is most efficient for water-based solution and charged wire for organic solvents. After electrospinning prepared nanofibrous composite of polymer and inorganic precursor was calcined in muffle oven and studied by various analytical techniques (TGA, SEM, TEM, PXRD, BET). Prepared polycrystalline nanofibers were in range of tens of nanometers in average diameter. The biggest surface area achieved in this work was 52 $m^2.g^{-1}$. ThO_2 has potential in heterogenous catalysis, refractory materials and nuclear power industry. Further work will be focused on finding optimal application for example as precursor of nanoceramics.

References:

Kundrát, V.; (2016) Diploma thesis