NANOSTRUCTURED APPROACH FOR REFRACTORY COMPOUNDS

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This invention relates to a generic process for producing a refractory oxide which comprises reacting liquid water with: at least one metal fluoride reactant; or at least one metal fluoride reactant and at least one metal oxide reactant; or at least one metal oxide reactant and an aqueous hydrogen fluoride solution, to produce either a colloidal mixture or a solution; drying either the colloidal mixture or solution; heating the dried product to produce a solid state metal hydroxyfluoride; heating the hydroxyfluoride to a temperature at which it chemically decomposes into a cationically-homogeneous and nanostructured solid state metal oxyfluoride; and performing one of the following heating steps: (I) to a solid state decomposition-temperature where the oxyfluoride chemically decomposes into a refractory oxide; or, (II) to a molten state decomposition-temperature where the oxyfluoride chemically decomposes into a refractory oxide; or, (III) to a vapor state decomposition-temperature where the oxyfluoride chemically decomposes into a refractory oxide [1].

In modern materials science increasingly common approach nanostructure. With this approach, the possibility of using nanotechnology to create various nanostructures, characterized by small size (from 1-2 to ~ 100nm) of the main structural components (grains, phase inclusions, layers and pores). Nanostructured approach, ensuring receipt variety of structural and functional materials with high physics-chemical and physics-mechanical properties, attracts considerable attention of scientists and engineers, accompanied by a significant increase in information.

Is interesting to consider that introduced a new approach to the problem of nanostructured materials based on the creation of refractory compounds. In this regard, there are several key moments of interest comrade :

• size range obtained inpowders (including multilayer) greatly expanded;

• modern nanotechnological methods synthesize not only nanopowders various forms but nanotubes and nanowires;

• thanks mechanosynthesis and other methods virtually no restrictions on chemical and phase composition of the synthesized nanostructures , characterized by a large non-equilibrium;

• varying modes of magnetron synthesis and implantation provides obtaining nanomaterials morphology of nanocrystal structures ;

• application of nanoparticles and gives nanograin opportunity to reduce the sintering temperature and a temperature display superplasticity ;

• due to the size effect fails increase the strength and hardness , as well as actively influence the other physics-chemical and physics-mechanical properties ;

• brittle refractory compounds begin nanostate in plastic strain [2].

The report analyzes in detail the above -the examples. Characterized new superhard, high oxidation resistance and optical materials based on refractory compounds , as well as amorphous-nanocrystallical composites for friction units .

Drawn attention to some little explored and unsolved problems (long and high temperature stability radiation resistance, strength conflict and the viscosity, etc).

References

1. Dugger; Cortland Otis. Production of transparent cationically-homogeneous nanostructured refractory oxides at reduced temperatures (patent US 6066305 A),- 2000.

2. Andrievskii R.A. Fundamentals of nanostructured materials science. opportunities and problems. M. BINOM., 2012. – 252 p.