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Tungsten-Based Powders Produced in Plasma Systems

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Abstract : The report presents the results of R&D of plasma-chemical production of W, W-Cu, W-Ni-Fe nanopowders as well as spherical micropowders of these compounds for their use in modern 3D printing technologies. Plasma-chemical synthesis of nanopowdersis based on the reduction of tungsten oxide compounds powders in a stream of hydrogen-containing low-temperature thermal plasma generated in an electric arc plasma torch. The synthesis of W-Cu and W-Ni-Fe nanocompositesiscarried out using the reduction of a mixture of the metal oxides. Using the synthesized tungsten-based nanocomposites powders, spherical composite micropowders with a submicron structure canbe manufactured by spray dryinggranulation of nanopowder suspension and subsequent densification and spheroidization of granules by melting in a low-temperature thermal plasma flow. The DC arc plasma systems are usedfor the synthesis of nanopowdersas well as for the spheroidization of microgranuls. Plasma systems have a capacity of up to 1 kg/h for nanopowder and up to 5 kg/h for spheroidized powder. All synthesized nanopowders consist of aggregated particles with sizes less than 100 nm, and nanoparticles of W-Cu and W-Ni-Fe composites have core (W) –shell (Cu or Ni-Fe) structures. The resulting dense spherical microparticles with a size of 20-60 microns have a submicron structure with a uniform distribution of metals over the particle volume. The produced tungsten-based nano- and spherical micropowderscan be used to develop new materials and manufacture products using advanced modern technologies.

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