Nanocomposites and nanomaterials

Chemicometallurgical method for tungsten based nanopowders obtaining

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The aim of this work was to develop low-temperature methods allowing to regulate the structure and properties of the final material obtained during the nanopowders manufacturing.

For the synthesis of nanopowders, a combined chemicometallurgical method was used combining metal hydroxides deposition from respective salts solutions with subsequent reduction of resulting intermediate product by hydrogen.

It was found that the most accurate results concerning the chemical composition of tungsten based nanocomposites can be obtained if the solutions concentration is within the range 5...75 g/l. In case of higher concentration solutions, the likelihood of deviation of the chemical composition increases significantly due to device errors during determination of the solutions concentration. If, vice versa, the solutions concentration is reduced, it is necessary to process their large volumes which significantly prolongs the duration of the synthesis and affect the quality of the final product.

As it can be seen from the thermogravimetric data, metallization of the chemical mixture occurs in several stages and within different temperature ranges. However, temperature ranges and temperature peaks characterizing the reduction of iron, nickel, cobalt, and tungsten components in the mixture are shifted to a low temperature region. The analysis of experimental phase analysis data obtained suggests that mechanisms of mutual influence of components are different.

X-ray analysis revealed the following phase composition of reduced nanopowders of tungsten based alloy, vol. %: W – 87.72; Ni – 6.14; γ-Fe – 2.63; Fe-Ni – 0.88; and Co – 0.88. The chemical composition of reduced nanopowder of tungsten based alloy is characterized by the presence of 89.9% tungsten, 7.2% nickel, 1.8% iron, and 1.1% cobalt.