N1-O-044001

MECHANOCHEMICAL SYNTHESIS OF COMPOSITES TUNGSTEN (MOLYBDENUM) - MAGNESIUM OXIDE*

T.A. UDALOVA[1,2], T.F. GRIGOREVA[1], S.V. VOSMERIKOV[1], E.T. DEVYATKINA[1], N.Z. LYAKHOV[1,3]

[1]Institute of solid state chemistry and mechanochemistry of the SB RAS, Novosibirsk, Russian
[2]Novosibirsk State Technical University, Novosibirsk, Russian
[3]Novosibirsk State University, Novosibirsk, Russian

Tungsten and molybdenum, possessing properties such as high T_{melt} and T_{boil}, density, hardness, low coefficient of linear thermal expansion and steam pressure, good electrical and thermal conductivity [1-2], finds application from metallurgy to electronics [3].

Mechanochemical reduction of metal oxides by an active metal magnesium leads to simultaneous grinding of the substance, acceleration of mass transfer, increase in the contact surface area, deformational mixing of mixture components and activation of their mechanochemical interaction. As a result, composites (Me/(MgO) are formed - powder mixtures of highly dispersed metal particles and active metal oxide.

Mechanochemical reduction of WO_3 (MoO_3) and $MgWO_4$ ($MgMoO_4$) with magnesium, proceeding with a high exothermic effect can be carried out in the process of only mechanical activation with the formation of a mechanochemical composites W(Mo)/MgO.

The goal of the work was to study the possibility of mechanochemical synthesis of magnesium wolframite (molybdate) from tungsten (molybdenum) and magnesium oxides, the formation of a W(Mo)/MgO composite during the mechanochemical reduction of WO_3 (MoO_3) and $MgWO_4$ ($MgMoO_4$) by magnesium, and the subsequent separation of highly dispersed tungsten (molybdenum) from MgO from the composites W(Mo)/MgO.

X-ray diffraction of $MgWO_4$ ($MgMoO_4$) mechanochemical reduction samples obtained with various stoichiometric compositions and mechanical activation modes showed that, with a ratio of $MgWO_4$ ($MgMoO_4$) : Mg = 1 : 3.1, the rotational speed of the vials around the common axis, the reduction is complete by 8 min with the formation W(Mo)/MgO composite. In the diffractograms of the samples of the mechanochemical reduction of magnesium wolframat (molybdate), only broadened reflections of MgO and W (Mo) recorded.

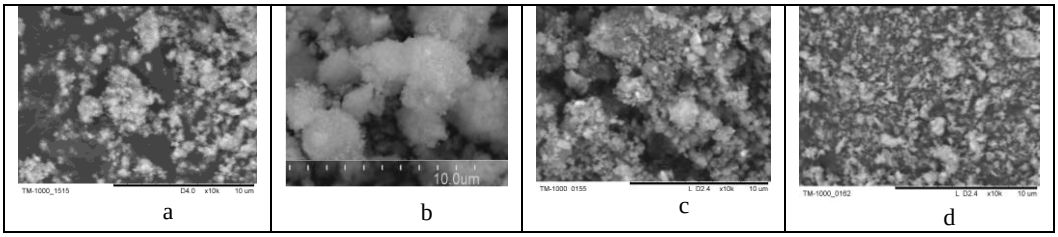

Fig.1. SEM: (a) W/MgO mechanocomposite; (b) highly dispersed W after acid treatment of mechanochemical composite W/MgO; (c) Mo/MgO mechanocomposite; (d) highly dispersed Mo after acid treatment of mechanochemical composite W/MgO, magnification 10000x.

Sequential treatment of W (Mo)/MgO composites with acid solutions leads to a product containing predominantly metallic tungsten (molybdenum). Particles of finely dispersed tungsten (molybdenum) have sizes of ~ 0.1 μm, aggregated into larger ones, with sizes of 2–4 μm.

REFERENCES

[1] Wang H., Fang Z.Z., Hwang K.S., Zhang H., Siddle D., Int. Journal of Refractory Metals & Hard Materials, 28 (2010) P. 312 – 316..
[2] Lassner E., Schubert W.D., Tungsten Properties, Chemistry, Technology of the Element, Alloys, and Chemical Compounds – Kluwer Academic, Plenum Publishers, New York, 1999.
[3] Schubert W.D., Lassner E. "Tungsten: properties chemistry technology of the element alloys and chemical compounds". N.Y.: Kluwer Academics, 1999, pp. 288.

* The work was supported by as part of the state task of ISSC SC RAS (project №. 121032500062-4) and as thematic plan TP - Chemistry and chemical technology -1_22.