INNOVATIVE DEVELOPMENTS OF THE INSITUTINS OF METALLURGICAL PROFILE OF THE RUSSIAN ACADEMY OF SCIENCES

ИННОВАЦИОННЫЕ РАЗРАБОТКИ ИНСТИТУТОВ МЕТАЛЛУРГИЧЕСКОГО ПРОФИЛЯ РОССИЙСКОЙ АКАДЕМИИ НАУК

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Abstract: *In the present work, examples of the successful development of new materials and technologies on the basis of fundamental research by members of the Russian Academy of Sciences are outlined. The topics include anticorrosive protective coatings based on ultrafine Zn powders; catalytic converters for vehicle exhaust gases; nanostructured stents for endovascular operations; and corrosion and wear resistant coatings and corresponding methods of plasma application. Methods have been developed for recycling of oily scale; for special electroproduction of steel for the power industry; synthesis of massive monocrystalline samples of transition metal nitrides and nanopowders of W, Pt, and Ti and their carbides and nitrides and others.*

***KEYWORDS**:* NEW MATERIALS, TECHNOLOGIES, NANOPOWDERS, WEAR RESISTANT COATINGS

1. Introduction

In the present work, examples of the successful development of new materials and technologies on the basis of fundamental research by members of the Russian Academy of Sciences are outlined.

2. Examples of developments

Institute of Metallurgy of Ural Branch of the Russian Academy of Sciences, Yekaterinburg City (IM) founded the Innovative Technology Centre “Akademicheskii”, with 10 000 m^2 total area. 12 Innovative Enterprises are working in this Centre.

Corrosion and wear-resistant coatings developed at IM, which are applied by plasma methods, have been introduced at enterprises including Yakutautotrans (Yakutsk), Tyumen’transgaz (Yugorsk), the Yekaterinburg and others [1–3].

Technology and equipment for production of shot and powders of ferrous and nonferrous metals. Technology was transferred to LLC "Invest-Ural“ (Nizhny Tagil, Sverdlovsk region, according to license agreement (Fig. 1). Licencing to company “CTRP” (Chelyabinsk) is in process.

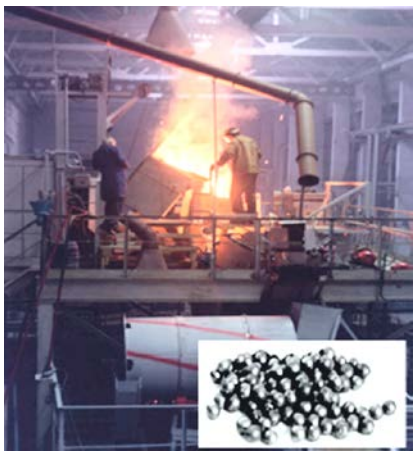

Fig. 1. *Production system for nonferrous and ferrous metal shot and powder at Akademicheskii Research and Development Center, Gran-Met Scientific Production Company.*

Researchers at Akademicheskii Research and Development Center and IM have created a fundamentally new waste-free system for the processing of molybdenum-bearing sulphide material [4, 5] (Fig.2). It is employed at a pilot plant producing rare earth elements, molybdenum trioxide, and calcium molybdate, with complete utilization of sulfur dioxide. Trial batches of molybdenum trioxide have been supplied to steel plants.

Fig.2 *Pilot plant to produce rare-earth elements, molybdenum trioxide, calcium molybdate and to make full utilization of sulfur dioxide*

Output production by plants of “Akademicheskii” engineering and technical center

- ✓ Antiwear additives: remetallizers of RiMET series (RiMET, RiMET-T, Motor HEALER), metal plaque lubricant Vympel;
- ✓ Ferromolybdenum FeMo, molybdenum trioxide MoO_3, calcium molybdate MoCa;
- ✓ Molded aluminum and brass pieces;
- ✓ Concentrates for precious metals obtaining;
- ✓ Precious metals (gold, silver, platinum);
- ✓ Combustion and heat-exchange equipment;
- ✓ Equipment for foamed concrete making;
- ✓ Metal beads with various typical sizes;
- ✓ Injection equipment for processing of metal melts.

At “Akademicheskii Research and Development Center (VMP Holding Company, associated with IM), on the basis of fundamental research into the evaporation and condensation of metals, a production technology was developed for ultrafine zinc powder and corresponding anticorrosion coatings [6, 7] (Fig.3). The coatings are used in oil and gas tanks and pipelines at the (Kuru space center (French Guyana) to protect the metal structures of the launch system for the Soyuz-ST rockets and in the construction of infrastructure (bridges, walkways, for example - Patriarchal bridge in Moscow, painting of load-bearing structures, constructions for the winter Olympics at Soch).

Fig. 32. *Production of metal powder by gas-phase synthesis and powder-based materials at "Akademicheskii" Research and Development Center: (a) production of zinc powder; (b) products based on bronze powder for the protection of frictional surfaces;(c) production of zinc-enriched paint.*

In collaboration with OOO Tekhnologii Tantalum, IM researchers have produced experimental batches of sintered tantalum nanopowder for use in tantalum capacitors by a new technology. The production conditions for these tantalum powders are consistent with the capabilities of OAO Elekond, which produces electrolytic high-voltage and chip capacitors. Nanopowders of other refractory metals and their carbides may be produced by this method, which is covered by two patents [8, 9]. It is possible to plate the powders so as to produce composite powders for additive technologies [10, 11].

A plasma system currently undergoing trials at IM could form the basis of a modern industrial version of the Korvet-6 plasma system equipped with a special system for powder preparation, with the possibility of maintaining the specified protocol in supersonic and hypersonic conditions [12, 13]. This system is intended for the application of external coatings at a rate of up to 30 kg/h (~150 m^3/h). Metals may be applied to paint coatings and even to an organic base (plastic, cardboard).

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