



Ion- plasma plating technology of powder materials in surface engineering

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National Technical University of Ukraine “Kyiv Polytechnic Institute” (NTUU “KPI”) was founded in 1898. It is the leading technical university of research type in Ukraine. The following world-known scientists were studying and teaching in the university:

Yevgeniy and Boris Paton – founders of almost all known welding processes and welding science itself,

Sergey Koroliov – rocket designer,

Igor Sikorskiy – helicopter designer,

Stepan Timoshenko – famous mechanician,

Sergey Lebedev – mathematician and others.

Detailed information may be found on <http://kpi.ua/>

Welding Faculty was founded in 1948 by Yevgeniy Paton. The Faculty is a part of Training Centre of NTUU “KPI” and E. O. Paton Electric Welding Institute. The Department coordinates activities of 17 subdepartments in different universities of Ukraine in the field of training of welding specialists and scientific research in welding and surface engineering.

For further information do not hesitate to visit <http://interweld.kpi.ua>.

Brief project specification

Ion plasma plating technology of powder materials is the process of deposition of metal vapors on the surface of powder using metallic plasma of vacuum arc. As a result on the surface of the powder particles submicroscopic and nanocrystal metallic films of high chemical purity are generated.

Technology allows:

- to plate any surface of metal powders, including ceramics, to produce heat, wear, corrosion resistant coatings;
- to receive plated powders based on non-deficit materials (Ti, Al, Cu)
- to receive composite materials by bonding and sintering of plated powders, for example, for the purposes of manufacturing of the cutting tool with high mechanical properties;



- to receive nanostructural alloys with extended strength properties, such as aluminum alloys precipitation strengthened by plated particles;
- to provide new catalysts for recycling chemical waste and cleaning of toxic gases.

Plating shell with high adhesion to the particle may be manufactured from almost any metals and alloys of high purity, as well as chemical compounds in the forms of oxides, carbides, nitrides.

Ion plasma plating of powders is carried out on the up-to-date vacuum-pumping assembly shown on fig. 1. The main specifications of the assembly: productivity – 10kg/h; capacity – 90kW; vacuum pressure range – $2,66 \times 10^{-3}$ Pa with reactive gas – $2,66 \times 10^{-1}$ Pa; rotational velocity of charging arrangement – $2 - 10 \text{ min}^{-1}$. The morphology of plated powder is shown on fig. 2. Cross-section of the powder particles Al_2O_3 plated by titanium and aluminum is shown on fig. 3.



Fig. 1. View of vacuum-pumping assembly for ion plasma plating

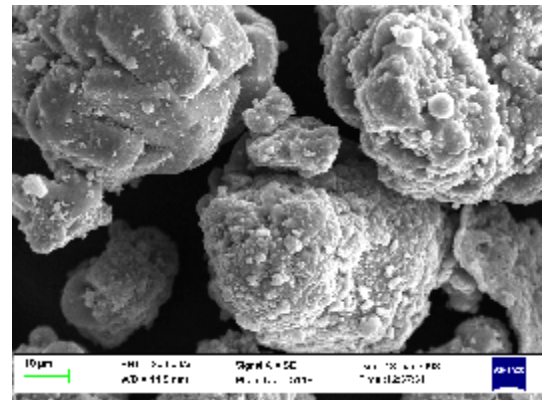


Fig. 2. Morphology of plated powder

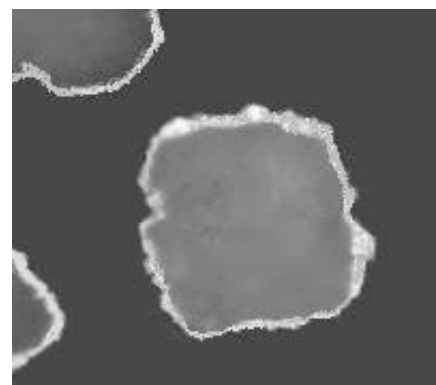
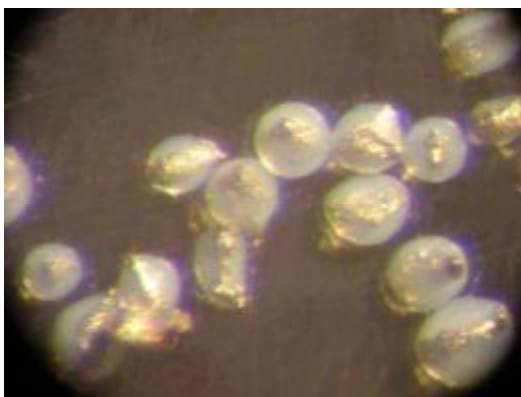


Fig. 3 Cross-section of the powder particles Al_2O_3 plated by titanium and aluminum



Results of practical applications

Plasma and detonation coatings with high adhesion-cohesion characteristics on the base of plated powders were provided. Tribological and corrosive tests have proved the coatings of plated powders to be very efficient.

Orientation of the activities of organizations to be interested in applications

Plasma coatings on the base of plated powders may be implemented in different industrial enterprises not only to restore but to improve worn-out surfaces. Ion plasma plated powder materials can be invaluable in the powder metallurgy, welding, brazing, surfacing, foundry, as well as in the development of new construction materials and tools for the purposes of machine engineering, shipbuilding, metallurgy, etc.

Presentation of vacuum-pumping assembly for ion plasma plating may be organized only on the welding faculty. Presentation of plated powders may be arranged anywhere.