

## COMPACTING OF POWDER MATERIALS BY STEP RADIAL DEFORMING IN CLOSED VOLUME

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### Problem Description

Powder Technology retains a leading position in the works of developing of new composites based on metals and alloys, oxygen and oxygen-free ceramics, heat-resistant polymers and superhard tool materials.

A considerable quantity of various layouts of compacting is examined both in theoretical, and in engineering-design aspects. Due to a study of processes of compacting and relaxing in powder compacts one of basic conclusions was obtained, that all of them come to various modifications of axial compacting of rods and sleeves.

Disadvantages of axial compacting are next. The gradient of porosity varies strongly along a rod or sleeve axes from 5 % on backs to 30 % in its central part. In addition axial compacting has a limitation of specific pressure on the instrument creating a pressure upon the powder compact and restricting volume of the compact. The powder compacts subjected to axial compacting have an insufficient operation life at loads of equal 50-70 % from destroying level.

At the same time high-cycle radial compacting which is known but almost not researched opens considerable possibilities in solving of the above-stated problems.

### The way of problem solving

To solve the above-stated problems at compacting of powder materials is possible by use of radial compacting, in particular cold step plastic deforming. Two ways of the method are a deforming broaching or reducing.

A process of radial deformation is used for compacting of powder materials, and for regulation of a structure of pressed compacts. Such structures of compacts are principally unattainable with other ways. It is possible to get the regular structures by means of the combination of wave loading and unloading processes which is proceeding parallel. For example, when the metal powders are taken under radial deforming it is possible to get the effect of directed plastic deformation of plastic metal particles along the axis of movement of the deforming elements. Such effect would allow getting goods with uniform, in advance set structure.

When deforming broaching is used it is possible a movement and a displacement of corruptions from powder compact due to wave character of shaping of the compact in proceed of its compacting.

When the radial compacting technology is based on the process of step deforming broaching high cycle loading is created in a condition of the regulated movement of an annulet of compacting with pressure increase in each following cycle of shaping. The basic elements of the technology are special device and tool – deforming broaching. To get the sleeves is enable from beforehand compacting briquette with high degree of compression and low gradient of stress and compaction in the radial and axial directions when the experimental device and tool will be developed. The inner metal sleeve as technological component of the device has several functions in radial compacting: the first - it limits the space which the powder is located in and makes it a closed, the second - it eliminates a friction between deforming element and compacted powder material because of it is an interlayer between its surfaces. To discard compacted goods from deformed metal sleeve without breaking the sleeve is made divided.

The processes of radial compacting of powder materials or deforming of powder compact are perspective at making of thin-walled, profile and lengthy goods, and also new materials with unusual structures. Deforming broaching can be used as a way of radial compacting for both plastic and fragile powders in the field of manufacture of ceramics (including extremely hard), porous filters, magnetic materials, special abrasive tools, anti-friction and wear-resistant materials.

### Basic publications

1. O. Rosenberg Getting long workpieces by cold compaction the powder in a rigid mold // Abstracts. International science. And Technical. Confit. "Application of the theory of plasticity in modern technologies fabrication and auto technical expertise." Vinnitsa, May 29 - June 1, 2006 - Vinnitsa: Vinnitsa NTU, 2006. - S. 20-22.

2. Rosenberg OA, EA Paschenko (Kiev). Study the structural features of powder materials subjected stepwise cold plastic deformation // Physical Chemistry - 2006 - № 6.

### Innovative Aspects of the solution / development / methodology, tool, prototype.

Application of a deforming broaching or reducing for radial compacting of powder materials is the alternative approach when an accent is transferred from use of the difficult and expensive process equipment on getting of qualitatively new results by more cost-effective means. For the first time a layout of radial compacting of powder materials that is almost not researched will be offered at plastic deforming. The device will be developed and resolved scientific-technological problems linked with reaching of necessary properties of a powder compact.

**Current stage of development** of the offered solution / development/ methodology, tool, prototype (*please, select*)

- Development phase – laboratory tested
- Available for demonstration – field tested
- Already on the market

**Intellectual Property Rights** (*please, select*)

- patent applied for (name countries in which you have applied for patents in)
- patents granted (enter the countries that have granted the patents; where the initial patent was granted and say a few words about the company)
- copyright
- exclusive rights
- secret know-how
- others (registered design, plant variety right, etc.)

**Collaboration Details** (Type of collaboration sought; *more than one option can be selected*)

- Technical co-operation
- Commercial agreement with technical assistance
- Joint Venture agreement
- License agreement
- Manufacturing agreement
- Financial resources

### Technology Key words

Compacting of powders, radial compacting, cold plastic step deforming