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## PROCESS FOR THE PREPARATION OF HOMOGENEOUS MIXED PRODUCTS

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The object of my invention is a process for the preparation from at least two different substances particularly from metals, of homogeneous mixed products, which with regard to their properties may be classified between true alloys and pure additive mixtures of the particles, such as are for example to be found in metalloceramic sintered substances. The process of this invention is particularly suitable for the preparation of mixed products from metals, which cannot, or can only with difficulty, be combined to form alloys.

As examples of mixed products which can be prepared according to this invention, mention may for example be made of silver+nickel, iron+lead, copper+iron, etc. The mixtures may be prepared in any desired proportions, as for example, 60% of silver+40% of nickel, 85% of iron+15% of lead, etc.

The process of my invention is also particularly suitable for the preparation of homogeneous mixed products from metals, which possess very different specific gravities, as for example aluminium and lead. In this case also products of any desired proportions may be prepared, for example products which contain 80% of aluminium and 20% of lead.

My invention enables products to be prepared which possess for example the properties of alloys of the components and also the properties of the components themselves. It is consequently possible, depending on the working conditions, for example, the nature of the components, proportions, more or less fine division of the particles, to cause one or other property to be more strongly manifested and another to be more or less repressed.

Mixed products, consisting for example of iron and lead, may be used for the preparation of oilless bearings. In such a case the iron functions to support the shaft, whilst the lead effects lubrication. In this case particularly favourable effects may be obtained if the two non-alloyable constituents, iron and lead, are disposed side by side in a state of very fine division.

Mixed products of for example silver and nickel may with advantage be employed for the production of electrical contact parts. In this case the silver mainly acts as conductor, whilst the nickel prevents the contacts from sticking.

The process of my invention may for example be carried into effect by subjecting the metals to be combined together, in a molten condition to such intensive mixing, that the constituents are present in an uniform distribution as possible in the mixture, and subjecting the mixture, before separation into its component parts has taken place, to a comminuting operation under rapid cooling.

Known processes and apparatus may be used for mixing the molten components. The mixing operation may for example be carried out in stirring apparatus with rapidly rotating stirrers, or intimate and thorough mixing may be effected by employing gases as stirring means, if desired several such procedures may be used in combination.

In order to comminute the melts or to convert the same into solid products containing the particles in intimate association with one another, known or customary apparatus may be employed. The melts may for example be sprayed or atomised with the aid of nozzles, impact devices or the like, by blowing a current of gas into a jet of melt and the like means. The comminuting process may also be promoted by special procedures, for example by centrifuging the comminuted melt against reflecting surfaces or baffle plates, whereby the melt is still further comminuted. Similarly suitable procedures, such as air-cooling, water-cooling or the like may be employed as auxiliary means and thereby the comminuting and setting process be promoted.

A particularly advantageous method of carrying out the process of my invention is to effect the comminution of the melt by causing the same to impinge on rapidly rotating elements, preferably discs, and at the same time effecting rapid cooling of the particles formed. Cooling liquid may for example be caused to impinge on the rotating disc simultaneously with the molten material, for example by spraying, and be atomised together with the metallic melt. The rotating disc is cooled thereby and owing to the sometimes explosive evaporation of the cooling liquid, the comminution of the metallic melt is promoted and at the same time an advantageously acting vapour atmosphere is produced in the comminuting space or chamber. If necessary, the walls of the atomising space may also be cooled and/or the sprayed material be intercepted in liquids.

The procedure may for example be followed of causing the intimate mixture of molten components to flow continuously out of the mixing vessel, for example, a satisfactorily operating stirrer, in the form of a jet or plurality of jets on to a rapidly rotating disc mounted in a closeable container and promoting the comminuting and solidifying process by suitable cooling procedures, for example by continuously spraying cooling water, for example with the aid of nozzles, on to the disc. The melt impinging on the disc is torn by the action of centrifugal force into fine or extremely fine particles. Depending on the speed of rotation of the disc, the thickness of the jet of melt, speed of feed (height of fall), viscosity of the melt, etc., the process may be extensively controlled, for example with regard to the degree of fineness of the product.

By spraying cooling water on to the disc, the

comminution of the melt is promoted; the disc is cooled and owing to the spraying and atomisation of the cooling agent a vapour atmosphere is produced, by which the particles traversing the same are cooled and are prevented from depositing on the walls of the container. In certain cases the action may be still further improved by special procedures such as irrigating or spraying the atomising chamber with cooling water, irrigating the walls and the like. The lower part of the container may be constructed as a water tank, in which the particles are intercepted and also quenched. It is also possible by passing a cooling gas current or gas currents through the atomising zone to effect as rapid cooling of the particles as possible and on occasion to prevent too rapid contact of the particles with any solid surfaces, for example the container walls. The gas current may in this case also simultaneously serve for cooling parts of the apparatus, particularly the rotating disc. An advantageous procedure is to introduce the gas stream in the neighbourhood, if desired the immediate neighbourhood, of the rotating disc or the point of impact of the melt, with the disc or by blowing cooling gas into the melt at the moment when the latter contacts with the disc or immediately beforehand to promote the comminuting action of the rotating disc. Known apparatus such as injectors, atomisers or the like may be employed for introducing the gases into the atomising chamber or for mixing or blowing gas into the melt.

The rotating disc may of course also be protected by known means against the action of the hot melt, for example by constructing it hollow and by introducing cooling water through a hollow shaft into the interior of the disc.

Particularly good effects are obtained by effecting the cooling and quenching by the combined use of cooling liquid and cooling gas, for example, by blowing cooling liquid on to the rotating disc and also introducing cooling gas into the comminuting chamber.

According to one embodiment of this invention gas is conveyed in such a way and at such speed through the atomising zone, that not only is a cooling action exerted, but at the same time the finely divided material centrifuged off from the disc is further conveyed through a gas stream. In this way it is possible to control the time intervening between the conversion of the melt into a finely divided condition and the collection of the finely divided material in a desired manner and for example to prevent too rapid contact of the particles with the walls or too rapid deposition thereof. An alternative procedure is for example to convey the particles formed or portions thereof with the aid of the gas stream into deposition or collecting chambers connected with the atmoising chamber. In this way it is possible to obtain the particles in individual fractions after the manner of wind-sifting.

The nature of the gas to be employed depends upon the nature and susceptibility of the melts to be worked up. Nitrogen, hydrogen, carbon dioxide, producer gas, illuminating gas and the like may for example be employed.

When working up metals, which tend to react with water, inert liquids or liquids having a reducing action, such as benzene, alcohols and the like, may be employed.

Instead of metals, other substances, which are normally non-miscible or only miscible with difficulty, may be combined together and converted into homogeneous products, containing the constituents in very uniform distribution. Metals and metal compounds, for example metal oxides, or metals and non-metals, for example graphite and the like, may, for example, be converted into homogeneous mixed products. The preparation of products from silver and graphite may be mentioned by way of example. Such products may for example be advantageously employed as electrical contact parts, the desired hardness being obtained by the graphite constituents, whilst the silver acts as a conductor.

In the preparation of the mixed products all the constituents of the initial mixture may be molten. An alternative procedure however is to employ one component or a plurality of components in a molten condition and to distribute another component or other components in for example a fine powdery condition or fine powdery form as uniformly as possible in the melt by stirring or the like procedures and to convert the mixture, whilst avoiding separation into its component parts, in accordance with the invention into smaller solid products which contain the components in a condition of uniform distribution.

In certain cases the procedure may be followed of first producing the mixture of the components in the atomising apparatus, for example by introducing the components in a molten condition in separate jets into the atomising apparatus, for example in such a way that the individual jets meet on the rotating disc or immediately beforehand. Furthermore, into a melt, which contains one component or a plurality of components, the other, for example a powdery, component may be introduced by blowing in or the like procedures.

The invention offers many possibilities for the uniform and intimate combination of substances, which hitherto could not be combined or could only be with difficulty combined to form homogeneous products. Particular advantages are to be found inter alia in the fact that the process may be regulated as desired in various directions, for example with regard to proportions, degree of comminution, degree of fineness, etc., and consequently the desired properties be imparted to the products, in order to adapt them in the best possible manner to any further intended treatments. Particles may for example be produced, which pass through a 10,000 mesh sieve or still finer particles or coarser particles.

The particles may for example also be influenced with regard to their density or porosity.

The multi-substance products prepared according to this invention may be employed for different purposes. They are inter alia admirably adapted for the construction of products and articles by metalloceramic methods. For example, it is possible by cold or hot compression of the products consisting of two or more components, if desired with the admixture of additional substances, to produce articles of the desired shape. The products may be worked up as such or if desired after intermediate treatments, such as comminution, sieving, etc.

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