Production of Ferrite Granules According to the Vacuum Hot Steam Process (VHSP)

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Abstract: For the granulation of ferrites according to the vacuum hot steam process (VHSP) a high-pasty material is used as starting material. Homogenizing and dispersing of the mixing components are made in an intensive mixer with rotating mixing pan and high-speed rotor by using high shearing forces. Granulation is made by drying. Superheated steam is passed through the material as drying medium under vacuum. The adjustment of the granule size can be reproduced. The granules are distinguished by an increased density, considerably improved homogeneity, higher abrasive resistance, homogeneous moisture distribution in the interior.

1. Introduction

The magnetic characteristics of ferrite cores strongly depend on the quality of the powdery raw materials and their production. Apart from other influences, not mentioned therein, the preparation in the sense of mixing and granulating before the calcining process for the formation of the polycrystalline microstructure is of very great importance.
Only recently, a new unconventional granulating process - the Vacuum hot steam process (= VHSP) - is used in practice in a big scale technology.

2. Conventional granulation

The conventional production of granules is mostly concerned by a two-stage process, where in general two machines are connected in series. In the first phase, the various powdery components are intensively drymixed. Depending on the composition and type of the components, the mixing times are varying, even when using an intensive mixer. The dry mixing is followed by a moistening of the mix at simultaneous formation of microgranules. For the following build-up granulation a so-called disk pelletizer is normally used in practice. Such and similar processes are considered more detailed under [1].

3. Vacuum hot steam granulation (VHSP) of ferrites

The demand for further quality improvements resulted in the new and unconventional vacuum hot steam granulating process (VHSP).

The heart of such a plant is an intensive mixer in vacuum-tight design with a rotating mixing pan (fig. 1). The rotary axis is slightly inclined to the vertical line. The rotor, adjustable in its speed, penetrates into the mixing pan from above. The mechanical conditions for the new process are the rotating mixing pan, the rotor, the inclined position of the intensive mixer and the wall scraper designed as flow deflector.

According to the VHSP, a kneadable mix with high consistency is firstly generated by overmoistening. Accordingly high shearing forces are arising in this phase by high differential speeds. These shearing forces are granting a maximum homogenizing and dispersing, even of the small components, the moistening of those are sometimes problematical.

Secondary agglomerates that are practically unavoidable with proper dry mixes, are surely avoided when applying the new process. However, this is a precondition for an optimum product quality after the calcining process.

3.1 Granulating by drying

Following to the dispersing and homogenizing process, the granulation takes place. The granulation of the kneadable mix is made by extraction of liquid according to the VHSP (fig. 2). This is a matter of a convective drying process under slight vacuum. The drying medium i.e. superheated steam is in a closed circuit.
By drying the moist ferrite mix, the consistency firstly is increased more and more. Consequently the shearing forces are rising, whereby the homogeneity of the mix increases more and more on the one hand, on the other hand the material starts densing. Progressive drying in connection with the mechanical influences of the intensive mixer results in the formation of the granules. The larges ones are generated at first and the small ones by the end of the process. The granule size distribution (fig. 3) is reproductivly adjustable depending of speed range of the agitator, its design, moisture content of the granules etc. Material properties of soft ferrite granules according VHSP versus conventional preparation are shown in Table 1.

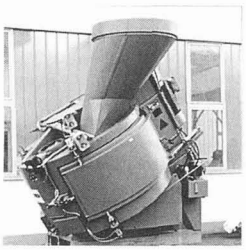

Fig.1 Vacuum-tight mix granulator
Photo: Eirich

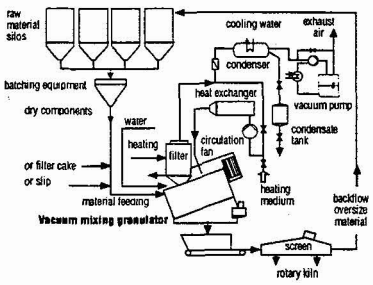

Fig. 2 Flow diagram for vacuum hot steam granulation of ferrites (VHSP) Eirich

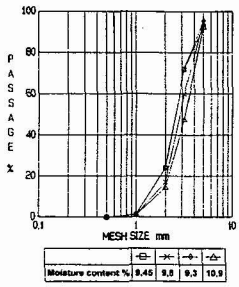

Fig. 3 Granule size distribution of soft ferrite granules according to the VHSP Eirich

4. Summary

For the ferrite industry, a process is made available by means of theVHSP, forming the basis to the increased requirements of the new products for a constant quality that can be reproduced.
The most important features are:

1. Constant quality of granules
2. Smaller diffusion distances within the granules
3. Higher density, homogeneity, abrasive resistance
4. The moisture in the interior of the granules is uniformly distributed
5. Closed system without harm to the environment due to the vacuum process
6. Increased capacity of the calcining kiln
7. Documented quality according to ISO 9000 ff

		VHSP	conventional
Bulk density of raw material	kg/l	0,8	0,8
Bulk density of granules	kg/l	2	1,5
Density of individual grain	kg/l	3 - 3,5	2,6
Humidity of granules	%	< 10	16

Table 1: Material properties
VHSP versus convential preparation

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