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PHYSICAL - MECHANICAL CHARACTERISTICS DEPENDENCE ON COMPACTING PRESSURE FOR REINFORCED WITH STEEL YARNS PIECES

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Abstract: *This paper presents researches of the authors about the influence of the compacting pressure and powder granulation above porous pieces reinforced with steel yarns. This type of pieces have been made from steel powder mixtures ANCORSTEEL 1000 B with controlled granulation reinforced at the buffer zone with massive yarns with Φ=0,3 mm and multicore yarns with Φ=0,45 mm. The samples have been pressed at 200, 300 and 400 MPa .The pressing was made orthogonally onto the placement direction of the yarns.*
The compacting has been made in a unidirectional compression mould with section of 7x51 mm. The sintering of samples was made at 1050-1100°C in a controlled argon medium.
There were obtained low densities of 5.8…6.5 g/cm^3.
Key words*: reinforced porous pieces, compacting pressure*

1. INTRODUCTION

In the last years human civilization has known a high development in the field of manufacturing technology. From this large field, the material technology has known the highest development. So, there were created new materials, few of them with spectacular characteristics. A field with high development is the one of classic composite or nanostructural materials. These new materials with special physic-chemical characteristics will replace the classic ones in the future. (Didu et al., 2005), (Didu et al., 2002) .On last years automotive industry has increased to better performance especially on reduction of weight. A part of pieces from automotive industry are obtained from powder metallurgy. (Didu et al., 2009).

Global trends can be grouped as: recycling, development of new technologies to reduce consumption of powder metallurgy and metal (Sinha et. al.,1992).

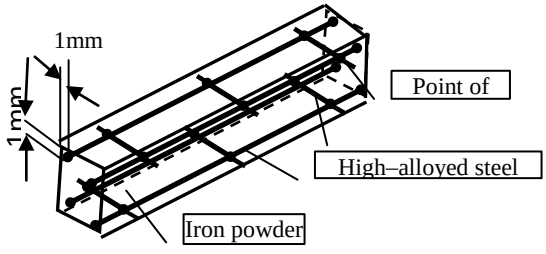

Fig. 1. The emplacement of the steel yarns reticulation inside the sintered iron piece

The researches desire as a result the obtaining of some high porosity light pieces for automobiles, but with high mechanical strength (bending strength, critical shear stress, stretching zone). (Dorofeyev & Dorofeyev ,1997)

For the study there have been made parallelipipedic samples of powder named ANCORSTEEL 1000 B , code 6086, made by SC. DUCTIL SA Buzau, Romania, reinforced in the border zone with high alloyed steel yarns located as in figure 1.

The yarns have been linked one with the other forming a spot – wealed reticulation, one in the inferior side and another in the superior side.

2. EXPERIMENTAL RESEARCH

For realizing study of some sintered powder parts with good mechanical and wear strength, we considered the following powder mixture: 1% zinc stearat and iron powder type ANCORSTEEL 1000B, cod 6086. made by S.C. Ductil S.A. Buzău.

The chemical composition and the physical features of iron powder are shown in tables 1 and 2.

Compozition	C	0	N	S	P	Si	Mn	Cr	Cu	Ni
[%]	<0.01	0.09	0.001	0.009	0.005	<0.01	0.10	0.03	0.05	0.05

Tab. 1**.** The chemical composition of the iron powder type ANCORSTEEL 1000B

Physical features										
The number of mesh [mm]									Flow rate s/50gr	Apparent density g/cm^3
0.8	0.4	0.31	0.25	0.2	0.12	0.1	0.07	Balance		
Particle size distribution [%]										
2.2	0.006	0.028	0.003	0.25	87.674	5.86	0.744	3.225	26	2,92

Tab. 2. The physical features of the iron powder typ ANCORSTEEL 1000B

The homogenization of powders with Zn stearat was obtained in a planetary mill Pulverisett 6, in 30 minutes with speed 250 rot/ min using 20 balls with Ø 10 mm.
The pressing was made at pressures of 300 MPa in a mould made of modulated elements which can be observed in figure 2.

For reinforcing there were used steel yarns with Ø 0.3 mm. The pressing was made orthogonally onto the placement direction of yarns. The compacting has been made unidirectional in a mould with section 7x51 mm.
The sintering was realized at 1100 º C, in a controlled argon medium, for 30 minutes.

For studying the compacts density dependent on compacting pressure was used powder mixture Ancorsteel 1000 B with granulations presented in table 2 and Zn stearat 1%.

It was used the same mould from figure 2 with section 7x51 mm.
The pressing has been made at compacting pressures: 200 MPa, 300 MPa and 400 MPa.
The samples sintering was made at 1100º C, fo3 30 minutes in protective argon medium.

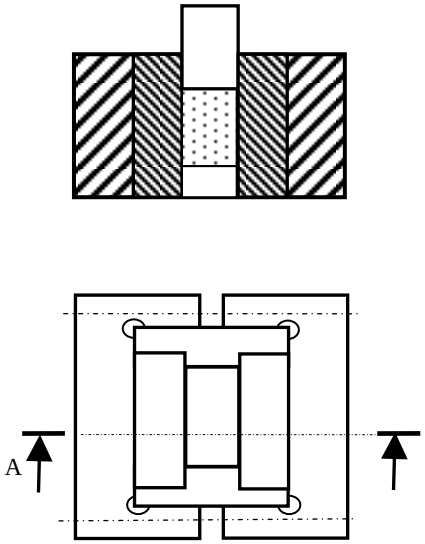

Fig. 2. The mould shape for pressing parallelipipedic samples

The aspect of parallelipipedic samples is presented in figure 3

Fig. 3. The aspect of the parallelipipedic samples

3. EXPERIMENTAL RESULTS

The density for crude and sintered pieces made of powder with different granulation at compacting pressure of 300 MPa and sintered at 1100 ºC is shown in figure 4.

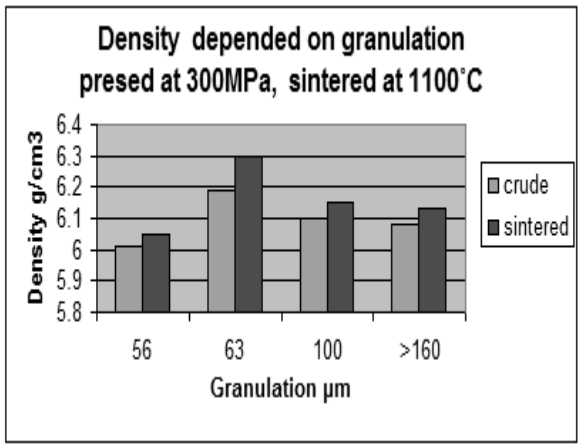

Fig. 4.The pieces density made of powder with different granulation

From figure 4., it can be observed density variations for different granulation for crude and sintered at 1100 ºC pieces used for tests.

For realizing the study of the pieces porosity variations dependent on the powder granulation have been used powders: 56 µm, 63 µm, 100 µm, and >160 µm.

Density values obtained by authors are beetween 6.05 g/cm^3 (for 40-56 µm) and 6.31 g/cm^3 (63 µm) for sintered pieces. Density variations of pieces dependent on compacting pressure can be observed in figure 3.2.

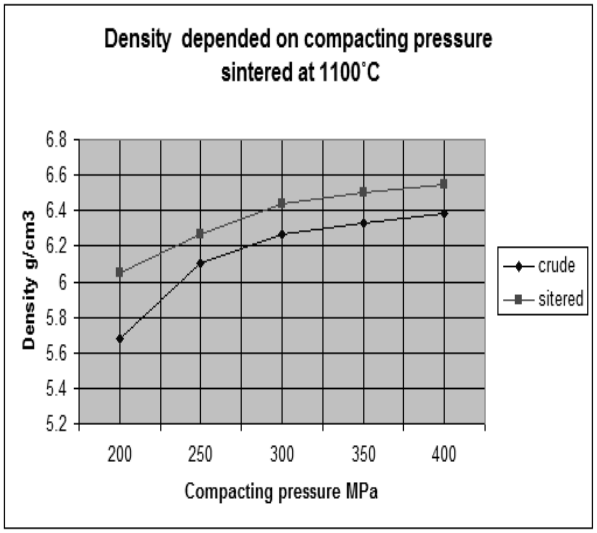

Fig. 5. Density variations of pieces dependent on compacting pressure

4. CONCLUSION

From this research's results can be observed that:

1. The density for reinforced with steel yarns pieces changes dependent on powder granulation. The lowest density is obtained for powder's granulation 56µm;
2. The density changes progressive dependent on compacting pressure. The sintered compact density variation is between 6.05g/cm^3 (200 MPa) and 6.55g/cm^3 (400 MPa).

5. REFERENCES

Didu, M., Radu, S., Mangra, M., Dumitru, C., (2005) Proceding of World Congress & Exhibition Euro PM, 2-5 october , Prague, Czech Republic, pag.99-102.

Didu M., Teişanu, C., Dumitru, C, Ciupitu, I., (2002) Proceding of International Conference DF PM, vol.2, Stara Lesna, Slovak Republic, September 15-18, pag.184-187

Didu, M**.,** Gruionu, L., Radu, St., Ghermec, C., (2009) Proceding of The 4th International Conference on Powder Metallurgy, Ro PM 2009, 8-11 iulie, Craiova, Romania, pag. 153

Dorofeyev Yu.G., Dorofeyev V.Yu.,(1997) Proceding of the 1997 European Conference on Advances in Structural PM Component Production, Munich, Germany, pp92-97

Sinha, A.K. (1992). Recent Developments in Iron and Steel Powder Production for High Performance P/M Components, In: *Production of Iron, Steel and HIgh Quality Product Mix*. Ch. 2, ASM International, USA