CASTING CORES MADE FROM POROUS CARBON

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Introduction

Highly porous carbon prepared by carbonizing foams of cross-linked thermosetting resin, e.g. phenol-formaldehyd, is an excellent thermal insulating material (1, 2). Suitable high-temperature insulating materials can also be made from hollow carbon microspheres which are produced from small pitch droplets (3). A normally disadvantageous property of these highly porous carbons is their high oxidation rate.

Porous carbon for casting cores

Sand cores are used for the manufacture of castings containing cavities and in special cases, cores are made of water soluable salts for cavities which are not easily accessible. Removal of the core material from the finished casting is not always easy and residues of this material may cause severe corrosion or even catastrophic wear. These difficulties may be avoided by using porous carbon casting cores (4, 5). The specification of a suitable porous carbon grade is presented in Table I. Casting cores can be easily machined by sawing, cutting or turning in useable range of tolerances. Owing to the low CTE of porous carbon the dimensional changes during pouring are insignificant. Usually the casting core has to be fixed within the mould to avoid floating in the molten metal. Casting cores used to form cooling channels are shown in Fig. 1 and 2. After solidification of the metal the casting core is ignited and burnt out. The burning rate can be accelerated by blowing oxygen onto the core. Only a very small amount of ash particles are retained which can be removed by washing.

Carbon fabric for casting cores

Instead from porous carbon the burnable casting cores can also be made from carbon fabric or felt (6). In this case the fabric would be wound on a mandrel and impregnated with a resin to strengthen the material and is afterwards machined to the final shape. This material is especially suitable for torus- or tube-shaped casting cores. As the burning rate is not as high as for porous carbon the fabric should be impregnated with suitable catalysts, e.g. alcali metal compounds or lead oxide.

Conclusions

Casting cores made from porous carbon and fabric are equally suited for the casting of aluminum, aluminum alloys and other non-ferrous metals. In contrast to other core materials the porous carbon can be removed without any residue from cavities which are not easily accessible.

References

1) Nobrac Carbon Ltd., Brit. Pat. 1 016 449 (1966)

2) Hochegger G., O. Vohler and H. Ernst, CVA 51 (1973)

3) Kureha Kagaku Kogyo K.K., Germ. Offen-legungsschrift 2 126 262 (1971)

4) Wischnack, W., Aluminium 50, 229 (1974)

5) Alcan Aluminiumwerk GmbH, Germ. Pat. 2 123 732 (1972)

6) Sigri Elektrographit GmbH, Germ. Offen-legungsschrift 2 418 070 (1975)

Table I

Specification of a porous carbon grade

bulk density kg/m^3	60
porosity %	95
compressive strength N/cm^2	70
thermal conductivity W/mK	0,05
CTE 1/K · 10^6	2,7
ash content %	0,2

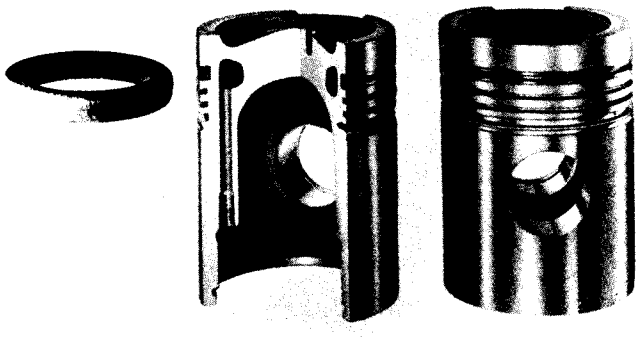

Fig. 1 Diesel piston with cooling channel, and torus-shaped casting core; outer diameter 220 mm

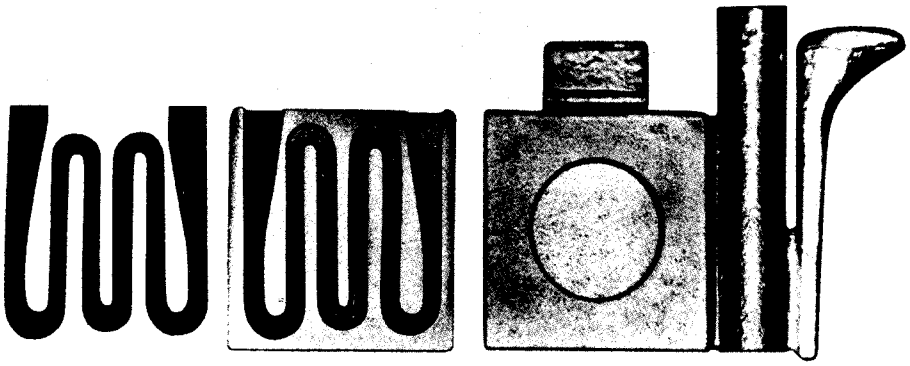

Fig. 2 Cooler with meander-shaped cooling channel