Universidad Carlos III de Madrid

OO/UC3M/47- DESIGN AND MANUFACTURING OF MASTER ALLOYS FOR SINTERING ACTIVATION IN HIGH PERFORMANCE STRUCTURAL PARTS

Nowadays, the development of high performance structural parts is limited by the fact that the alloying systems are being modifying by requirements associated to environmental guideline as well as to the increase in the price of raw materials. The use of masteralloys allows to activate the mass transport processes during sintering with a minimum modification of final composition (low cost) acting on densification, and hence, on final properties.

The research group of “Powder Technology” from Carlos III University has a wide experience and qualification on the design of new alloying systems and in manufacturing the powders by atomization and mechanical alloying techniques.

The Group is looking for companies interested in technical cooperation or manufacturing agreement.

Description and special features

In conventional powder metallurgy for low alloy steels, elements such us Cu, Mo and Ni are commonly used due to their low oxygen affinity and the good mechanical properties obtained in the sintered steels. However the increasing cost of these elements, combined with the difficulty for recycling Cu and the health problems derivate from Ni handling, makes it interesting to study new alloying systems based on novel elements which result more economical.

Using master alloy technique, the elements with high affinity for oxygen, such us chromium, vanadium, manganese and silicon can be easily introduced into sintered steels.

Master Alloy Powder is a prealloyed powder of high concentration of alloy content, designed to be diluted when mixed with a base powder to produce the desired chemical composition, microstructure and properties. Master Alloy powders admixed to iron based powder are particularly formulated to increase the hardenability of the final compact. There must be an optimization of the master alloy composition, shape, size and amount to improve the kinetics of the sintering process.

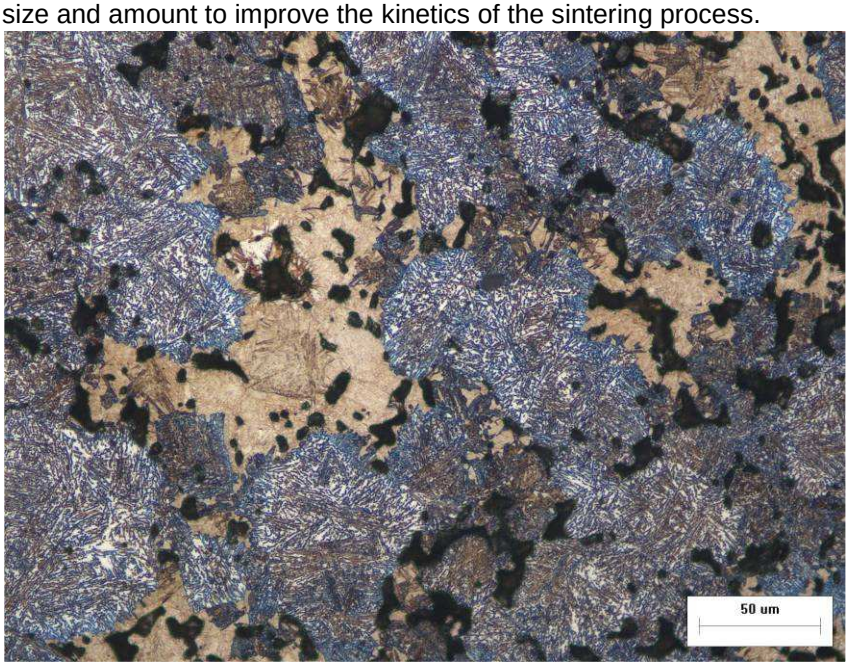

Fig. 1. Microstructure of Mo sintered steel modified with master alloys.

There are two factors that favours the effect of masteralloys additions:

- The presence of Carbon in the Master alloy is recommendable, since it provides self protection against oxidation. The use of high carbon master alloys is one of the most promising approaches found so far.
- The appearance of a liquid phase during the sintering accelerates the sintering process and has a positive effect on the homogenization of alloying elements.

Innovative aspects

The composition of the master alloy is adjusted depending on the development requirements of the part, being an attractive method to. Besides, the alteration in the final composition is imperceptible.
Cost reduction related on raw materials

Competitive advantages

- Cost reduction related on raw materials
- Diminution of total amount of alloying elements
- Sintering efficiency.
- Final properties improvement

Technology Keywords

Metals and Alloys; Moulding, injection moulding, extrusion, sintering

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