Problems of surface carbon in Chinese Lost Foam cast parts

When it comes to the Chinese variant of lost foam process casting defects and surface carbon is a common problem. This is because like all variants of the lost foam casting process the Chinese process too uses foam patterns that contain carbon, whether it is EPS (expandable polystyrene) or STMMA.

*Pyrolysis is a thermochemical decomposition of organic material at elevated temperatures in the absence of oxygen (or any halogen). It involves the simultaneous change of chemical composition and physical phase, and is irreversible. The word is coined from the Greek-derived elements *pyro* "fire" and *lysis* "separating"*

**It is especially an obstacle in the casting of ductile iron.** During the pouring process, most of the *pyrolysis* product (carbon) of the foam pattern has already been drawn out via vacuuming, leaving a significant amount of the carbon in the mold.

Whereas in the foamcast process the metal does not come in contact with foam pattern at all. A thin ceramic shell is created similar to the lost wax/investment casting process and the metal is poured into the shell backed by compacted, free flowing silica sand under vacuum.
Pouring temperatures of ductile iron cannot be as high as that of steel.

High pouring temperatures of ductile iron result in decay of the spheroidization process

*Spheroidizing* is a form of heat treatment for iron-based alloys, commonly carbon steels, in order to convert them into ductile and machinable alloys

Pouring of ductile iron at low temperatures in the Chinese lost foam casting process results in incomplete gasification. 

Ductile iron has a very high carbon content generally more than 3.6%

Ductile iron cannot absorb the excess carbon created during pouring, resulting in the carbon from the foam pattern being left on the surface and within the casting.

This 'leaving behind' of the carbon on the casting's surface leads to flow marks.

Carbon inclusion is caused by the pyrolysis product left in the casting itself, as it cannot be discharged or absorbed by the high carbon content ductile iron. This results in carbon inclusion formed by the carbonization of the foam in the product.

**Expandable Polystyrene (EPS) and STMMA**

*Expandable Polystyrene (EPS)* is the most widely used pattern material in lost foam casting process because:

a. The gasification of low density expandable polystyrene is rapid.

b. The EPS raw material is plentiful and molding EPS is an inexpensive

But in the Chinese process EPS causes substantial casting defects such as pores and flow marks because of its high carbon content (up to 92%).
The pyrolysis of EPS is also disorderly and slow fracturing, resulting in the formation of a solid pyrolytic carbon residue.

In 2001 a lost foam casting specific copolymer material (shortened to STMMA) was developed, consisting of 30% styrene and 70% methyl-methacrylate (with a carbon content of 69.6%). With a significantly lower carbon content, STMMA also contains oxygen, able to further reduce the amount of residual carbon that combines with carbon atoms.

**Although STMMA has shown to be effective in reducing the castings defects in ductile iron castings, including the formation of flow marks, carbon surface defects as well as carbon inclusion the availability STMMA is not universal as compared to EPS.**

 İn the foamcast process cup grade EPS is used to mold the patterns which is universally available. The carbon generated by EPS does not interfere with the casting composition as EPS is burned-off before metal is poured in an empty inert shell.

*For more information about foamcast please visit [www.foamcast.in](http://www.foamcast.in)*

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