Evaporative Pattern Casting Process

The Evaporative Pattern Casting Process is also known by several other names such as Full Mold Process, Lost Foam Process etc.

H.F. Shroyer patented the foam patterns for metal casting on April 15, 1958. In this patent, expanded polystyrene (EPS) block was used by him to machine the pattern and during pouring, it was supported by bonded sand. This process is called as full mold process. In the full mold process, the pattern is usually machined from an EPS block and is used to make large one-of-a-kind castings primarily. Originally this process was also known as ‘lost foam process’.

M.C. Flemming in 1964, used unbounded sand with the process. This is known today as lost foam casting (LFC). With LFC, the foam pattern is molded from polystyrene beads. LFC is differentiated from full mold with the use of unbounded sand (LFC) as opposed to bonded sand (full mold process).

The Evaporative pattern casting process (EPC) process is a binder less process and no physical bonding is required to bind the sand aggregates. Foam casting techniques have been known by a variety of generic and proprietary names such as lost foam casting, evaporative pattern casting, cavity less casting, full mold casting and evaporative foam casting. In this method, expanded polystyrene is used to prepare the complete pattern including the gates and risers. This pattern is further embedded in a sand of no bake type. The molten metal is poured through the sprue, while the pattern is still inside the mold. The heat of the molten metal is sufficient enough to gasify the pattern and the pattern progressively gets displaced by it.
Using unbounded sand and expandable polystyrene pattern, the EPC process is a very economical method in producing complex, close-tolerance castings. The expandable polystyrene can be molded into numerous complex and rigid shapes and it is basically a thermoplastic material. In the EPC process, expandable polystyrene patterns are attached to an expandable polystyrene gating system and a refractory coating is applied to the entire assembly. Once the coating gets dried, the entire foam pattern assembly is kept on loose dry sand in a vented flask. The flask is vibrated and additional sand is added to it until the pattern assembly gets completely embedded in sand. Molten metal is then poured into the sprue which further vaporizing the foam polystyrene and reproduces perfectly the used pattern.

In this process, a pattern used refers to an expandable polystyrene or foamed polystyrene part which gets vaporized by the molten metal. For every casting process, a new pattern is required.

Advantages of EPC Process

- In the EPC process, no cores are required making it the most advantageous.
- No requirement for binders or other additives, as it is a binder less process
- Complete sand reclamation is possible using very simple and inexpensive techniques
- Sand shake out is easy as the sand is unbounded
- Since the pattern used in EPC process is one piece, hence no parting line and since cores are eliminated, hence no core prints. Also, no mismatch, core shift because of the mentioned reasons
- Improved casting quality. Close tolerances are possible
- The EPC is an environmentally favorable process
- As it is a binder less process, the efforts on cleaning the molded sand are virtually nil. Therefore, the EPC process is viewed as a value-added process rather than a substitute for sand casting.
Disadvantages / Limitations of EPC Process

- Since every casting requires a new pattern, it is a costly process
- There is a limitations on the minimum section thickness of the pattern
- Quality of the casting fully depends upon the quality of the pattern
- As the sand is unbounded, during pouring, because of the difference of the evaporation rate of the metal and flow rate of the metal, sand falls down in the cavity generated. Hence, defective casting.

Application of EPC Process

- It is used for making automotive components (cylinder heads, engine blocks, inlet manifolds, heat exchanger, crank shaft)
- It is used in marine, aerospace and construction industries