Lecture 9

4-c. Full Mold Process / Lost Foam Process / Evaporative Pattern Casting Process

The use of foam patterns for metal casting was patented by H.F. Shroyer on April 15, 1958. In Shroyer's patent, a pattern was machined from a block of expanded polystyrene **(EPS)** and supported by bonded sand during pouring. This process is **known as the full mold process**. With the full mold process, the pattern is usually machined from an EPS block and is used to make primarily large, one-of-a kind castings. The full mold process was originally known as the **lost foam process**. However, current patents have required that the generic term for the process be full mold.

In 1964, M.C. Flemmings 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 by the use of unbounded sand (LFC) as opposed to bonded sand (full mold process).

Foam casting techniques have been referred to by a variety of generic and proprietary names. Among these are ***lost foam***, ***evaporative pattern casting***, ***cavity less casting***, ***evaporative foam casting***, and ***full mold casting***.

In this method, the pattern, complete with gates and risers, is prepared from expanded polystyrene. This pattern is embedded in a nobake type of sand. While the pattern is inside the mold, molten metal is poured through the sprue. The heat of the metal is sufficient to gasify the pattern and progressive displacement of pattern material by the molten metal takes place.

The (EPC) **Evaporative Pattern Casting** process is an economical method for producing complex, close-tolerance castings using an expandable polystyrene pattern and unbonded sand. Expandable polystyrene is a thermoplastic material that can be molded into a variety of complex, rigid shapes. The EPC process involves attaching expandable polystyrene patterns to an expandable polystyrene gating system and applying a refractory coating to the entire assembly. After the coating has dried, the foam pattern assembly is positioned on loose dry sand in a vented flask. Additional sand is then added while the flask is vibrated until the pattern assembly is completely embedded in sand. Molten metal is poured into the sprue, vaporizing the foam polystyrene, perfectly reproducing the pattern.

In this process, a pattern refers to the expandable polystyrene or foamed polystyrene part that is vaporized by the molten metal. A pattern is required for each casting.

Process Description (Figure 12)

1. The EPC procedure starts with the pre-expansion of beads, usually polystyrene. After the pre-expanded beads are stabilized, they are blown into a mold to form pattern sections. When the beads are in the mold, a steam cycle causes them to fully expand and fuse together.
2. The pattern sections are assembled with glue, forming a cluster. The gating system is also attached in a similar manner.
3. The foam cluster is covered with a ceramic coating. The coating forms a barrier so that the molten metal does not penetrate or cause sand erosion during pouring.
4. After the coating dries, the cluster is placed into a flask and backed up with bonded sand.

5. Mold compaction is then achieved by using a vibration table to ensure uniform and proper compaction. Once this procedure is complete, the cluster is packed in the flask and the mold is ready to be poured .

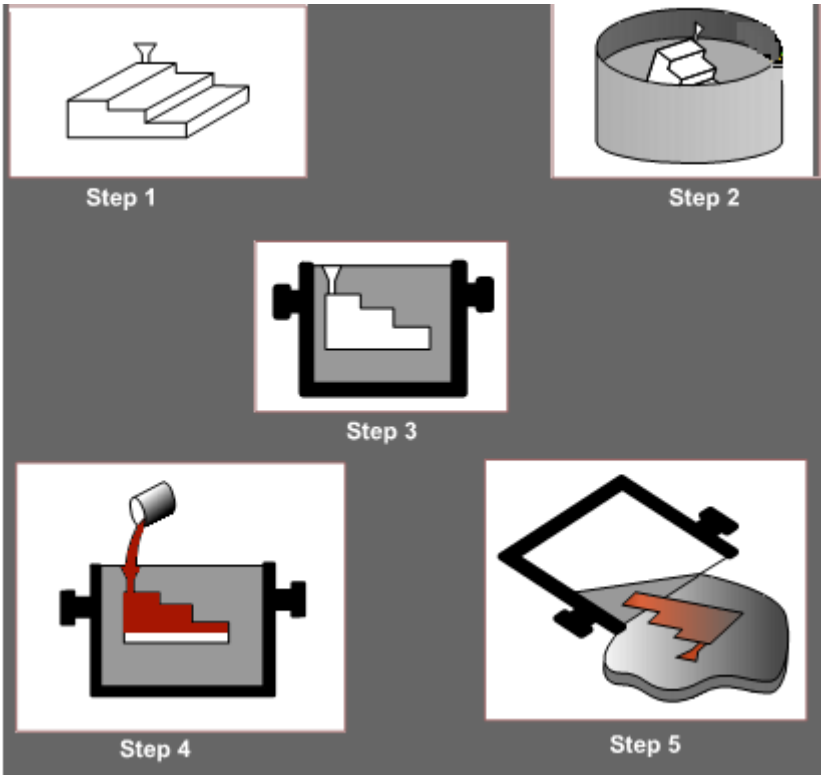

Figure 12: The Basic Steps of the Evaporative Pattern Casting Process

Advantages

The most important advantage of EPC process is that no cores are required. No binders or other additives are required for the sand, which is reusable. Shakeout of the castings in unbonded sand is simplified. There are no parting lines or core fins.