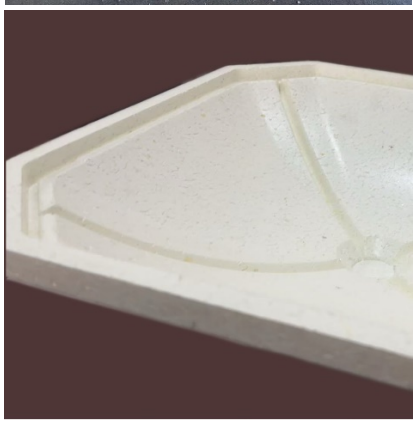
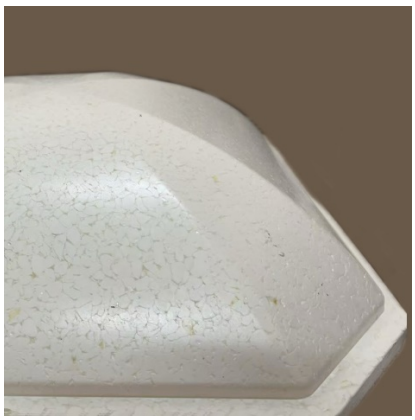
In-mold Foaming of ARCHCELL® FIT granule



ARCHCELL® FIT is a type of PMI granule that can be foamed directly in the mold by heating to form a specific shape, which has obvious advantages in the molding of complex shaped components. It is available in two forms: one is a copolymer granule; the other is a granule that has been pre-foamed at a specific temperature and time.

1 Categories of FIT granules

FIT granule can be divided into ACFIT, VPFIT and LPFIT granule according to the performance and cost of foam after foaming, among which, ACFIT granules have the best performance of foam formed after foaming, and the process is also relatively gentle, so it belongs to the high-performance FIT granule; VPFIT granule, whose performance is close to that of ACFIT, but with a slightly higher foaming temperature, belongs to the mid-range granule; whereas, LPFIT granule is a more cost-effective granule, with a wider range of applications.

2 Granule mold foaming process

2.1 Copolymer Granule Foaming

(1) According to the volume and density of the actual part weighing the required granular material, and then placed in the mold for foaming, in the calculation of the need to set aside 3% of the mass loss, so that the density is more accurate, granular material should be as far as possible uniformly spread in the mold.

(2) Foaming recommended temperature of 200 ~ 240 ℃, different granule slightly different (see Table 1 for details), the time for 15 ~ 90min, for example, 230 ℃ foaming temperature and 30min foaming time, foaming process requires clamping force of 3 ~ 4Mpa. note that the temperature and time for the temperature and time in the mold, the actual operation needs to take into account the thickness of the mold and the efficiency of heat transfer and the appropriate time. Change the time.

(3) The mold can be completely cooled to below the foaming temperature (below 120℃ overall) for demolding.

(4) Foaming can be done in an oven or in a hot press.

(5) Optionally, additives, such as mold release agents, may be added prior to foaming to aid in final demolding.

Table 1 Recommended foaming temperatures for copolymer granule foaming

Granule Size / FIT Category	5-20 mesh	20-60 mesh	60-100 mesh
ACFIT	200-240℃	200-240℃	210-240℃
VPFIT	210-230℃	220-230℃	220-230℃
LPFIT	200-210℃	205-215℃	205-215℃

2.2 Pre-foamed granule foaming

(1) According to the volume and density of the actual components, weigh the required pre-foamed granules, and then placed in the mold for foaming, in the calculation of the need to allow for 3% of the mass loss, so that the density is more accurate.

2) Set the mold temperature to 140℃, add the pre-foamed granule, the granule should be spread as evenly as possible in the mold, close the mold, the mold will be heated up to 220℃ within 10min (recommended temperature see table 2), keep at this temperature for 8~40min, the clamping force required for this process is 3~4MPa.

(3) Set the mold at 40℃ and keep it for 12min, then demold it.

(4) Foaming can be done in an oven or a hot press.

(5) Additives, such as mold release agents, may optionally be added prior to foaming to aid in final mold release.

Table 2 Recommended temperatures for foaming of pre-foamed granule

Granule Size / Category	5-20 mesh	20-60 mesh	60-100 mesh
ACFIT-P	180-200℃	180-200℃	190-220℃
VPFIT-P	190-210℃	200-210℃	200-210℃
LPFIT-P	180-190℃	185-195℃	185-195℃

3 Problems and solutions during molding

Problem 1: Foam is not formed and the granule remain in a fragmented granular state;

Solution: the foaming temperature needs to be raised by 20-30℃.

Problem 2: No foam is formed, but the granules are bonded together, and the granule fall off when slightly touched;

Solution: further increase the foaming temperature by 10-30℃.

Problem 3: No foam formed, but the granules are bonded together, and the volume exceeds the mold generally above;

Solution: Extend the foaming time for more than 30min.

Problem 4: Formation of foam, but a part is not dense enough, showing obvious granularity;

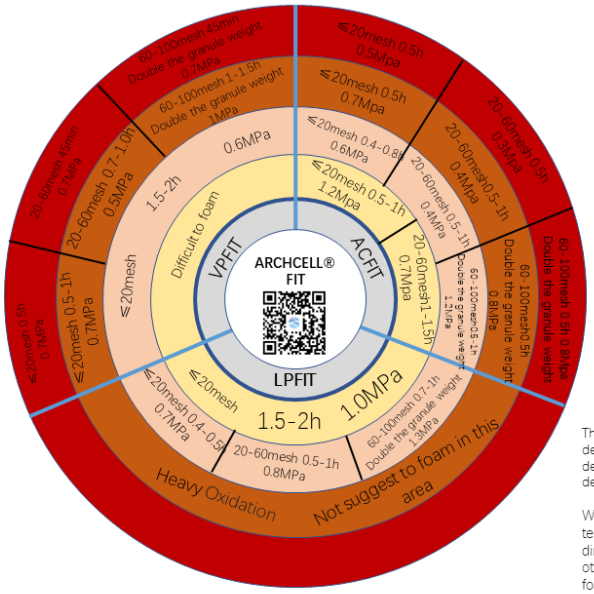
Solution: Extend 10-20min.

Problem 5: Formation of foam, but part of the granule overflow from the gap;

Solution: Reducing the amount of mold entry, sealing the mold joints and clamping the mold.

REINCHEM

FIT granule foaming condition



The strength here refers to the 5% compressive deformation strength (for reference, part of the demoulding was not smooth, and the actual density was not measured);

Warmup-temperature foaming must have a temperature-warmup process, and cannot be directly placed in a high-temperature oven, otherwise small particle will not be fully foamed.