# Processing Parameters for Mica Reinforced Polypropylene

## MELT COMPOUNDING

### WHEN TO USE MELT COMPOUNDING

- Typically recommended for resins that are only available in pellet form.
- With fine mica grades. When larger flakes are employed, exercise care to prevent excessive breakdown during the compounding step.

### PROCESSING TIPS

- Either continuous (single or twin screw extruder) or batch processes can be used.
- In general, mica flakes disperse in a molten resin easier than fillers (such as talc) or glass fibers. As a result, the energy input required can be reduced significantly when compounding with mica.
  - Flake degradation normally increases with mica concentration and is more pronounced for larger flakes than for finer flakes.
- Excessively high shears should be avoided with all mica grades because it may lead to flake degradation and consequently a decrease in the mechanical properties of the final composite.
- In a continuous process, these conditions are recomended to minimize flake attrition:
  - Minimization of kneading elements in the zones following the introduction of mica.
  - A side feed configuration for addition of mica. In order to avoid the high shear of the screw, the side feeder should be located after these zones.
  - A downstream temperature profile, i.e., higher temperature in rear zone than in front zone.
  - A corotating system is desired in a twin screw extruder (vs. a counterrotating system).
- Example compounding conditions using Suzorite® 60HK in polypropylene are shown.

### COOLING & CUTTING

- Less cooling before pellet cutting is recommended due to mica's inherent high thermal heat capacity and stiffening effects.
  - Cooling at the level common with nonreinforced extrudate may lead to breaking of the strands before cutting.
- Water bath cooling may be eliminated in certain resins with high mica content.

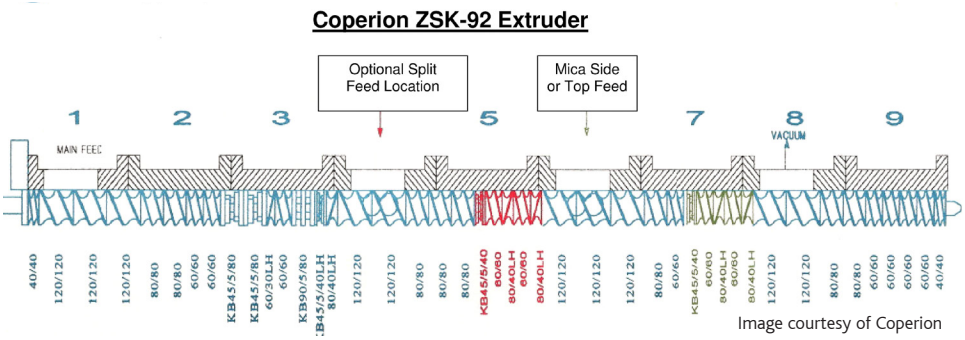


Image courtesy of Coperion

**Mica** improves many critical properties of thermoplastic composites. It can be used in a blend with powdered resin or in pre-compounded form. Mica is adaptable to virtually any processing method. As with any additive, the full benefits of mica's reinforcing properties are obtained when several processing parameters are controlled. This bulletin provides advice on the most effective ways to use mica reinforcing flake in **injection molded polypropylene.**

### PERFORMANCE IMPROVEMENTS

- Increases flexural modulus
- Improves heat deflection temperature
- Prevents warpage and shrinkage
- Reduces CLTE
- Suppresses sound and vibration
- Good electrical insulation properties

### Conditions for compounding polypropylene with 30 wt% of Suzorite 60HK using a Coperion ZSK-92 extruder.

| Zone | Temperature (˚C/˚F) |
|---|---|
| Rear | 280/535 |
| Middle | 260/500 |
| Front | 230/445 |
| Die | 200/390 |

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# DRY BLENDING

## WHEN TO USE DRY BLENDING

- Direct molding is recommended for dry blends containing powdered resins and larger flake mica grades. This process will minimize flake breakdown and allow the processor to achieve optimal mechanical properties.
- Dry blending should be restricted to coarser grades of mica due to the bulky nature and difficult feeding characteristics of fine grades. Little to no advantage is achieved in dry blending finer grades of mica.
- The dry blending method may result in substantial cost savings, especially in large volume applications, due to the elimination of costly compounding steps.

## PROCESSING TIPS

- Pre-blending in the dry form may be carried out by batch drum tumbling, ribbon mixers, or other low shear equipment.
- Alternatively, the blend may be prepared directly in the hopper of an injection molding machine possessing a metering-mixing capability.

# INJECTION MOLDING

## WHEN TO USE INJECTION MOLDING

- Screw or ram injection molding machines equipment with hot or cold runner molds may be used to process mica reinforced thermoplastics. During extrusion, some flake breakdown occurs in the barrel and along runners and gates, especially for larger mica flakes.
- Use of hot runner systems tends to minimize flake degradation along runners and gates, thereby improving molding characteristics and permiting the fabrication of parts containing high concentrations of mica.

## PROCESSING TIPS

- Barrel temperature settings are normally higher than for unfilled resins and should be increased with increasing mica content.
- A downstream temperature profile, i.e., higher temperature in rear zone than in front zone, may be advantageous in reducing flake breakdown.
- Screw speed and back pressure should be kept to the minimum possible, consistent with obtaining a homogeneous melt.
- Gate size should be chosen according to flake size in order to prevent blocking and poor flow.
- Composites containing fine mica flakes may be reground and reprocessed with no change in properties. However, a decrease in properties may be expected for composites containing larger flakes.

**Typical processing conditions for injection molded polypropylene containing 30-50 wt% mica.**

| | |
|---|---|
| **Predrying** | Normally not required |
| **Cylinder Temperatures (˚C/˚F)** | 205-225/400-440 |
| **Mold Temperatures (˚C/˚F)** | 30-70/85-160 |



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IMERYS PERFORMANCE MINERALS
100 Mansell Court East, Suite 300, Roswell, GA 30076 USA | t: +1 770-594-0660 f: +1 770-645-3384
e: perfminsNA@imerys.com | **www.imerys-perfmins.com/usa**

IMERYS Performance Minerals