PF6212AA and KJ processing guide

INEOS Polyolefins' metallocene LLDPE products, PF6212AA & PF6212KJ, are at the forefront of PE designed for film applications. They offer leading extrusion performance together with enhanced end product properties. To maximize the benefits of these products alterations to traditional extrusion settings should be considered.

Extrusion temperatures

The temperature profile normally used for Ziegler LLDPE blown film resins (MI ca. 1g/10min) can be the same for PF series resins. However, in order to achieve even better mechanical properties, in some cases we have observed that a higher melt temperature is beneficial. This is due to a quicker relaxation of long chains at higher temperature leading to less MD orientation.

Therefore we recommend increasing by 10 to 20°C the last extruder zone and head temperatures. A typical temperature profile will therefore be:

- **160°C** (first zone) to **195°C** (last zone) for the barrel
- **210 °C** to **220°C** for the head (adaptor) and die

To prevent degradation the increase of die temperature should not exceed 240°C and should be adapted to the bubble stability which may be adversely affected by too high a temperature.

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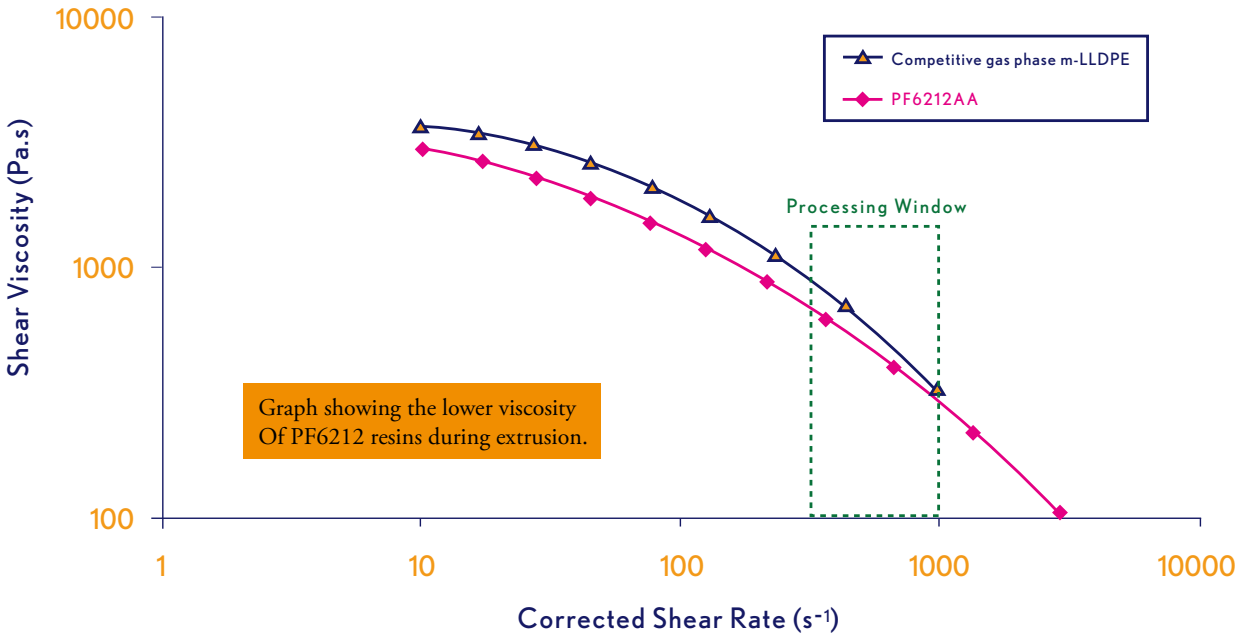
Processing aid

PF6212 series resins do not normally need addition of PPA, even if they are used pure. This is due to their special structure which leads to low viscosity during extrusion (strong shear- thinning behaviour). Significant cost reductions can therefore be achieved (typically 10 to 20€/t of film).

Processability: Capillary Shear viscosity at 190°C



Graph showing the lower viscosity Of PF6212 resins during extrusion.

Nevertheless, if severe extrusion conditions (high output, narrow die gap, high pressure) are used, it may be necessary to add PPA. **If this is the case, typical addition level is 1 to 2% masterbatch.** A higher die temperature as recommended above for extrusion should also help to avoid the need for PPA.

Use of PF6212 series resins pure or in blends

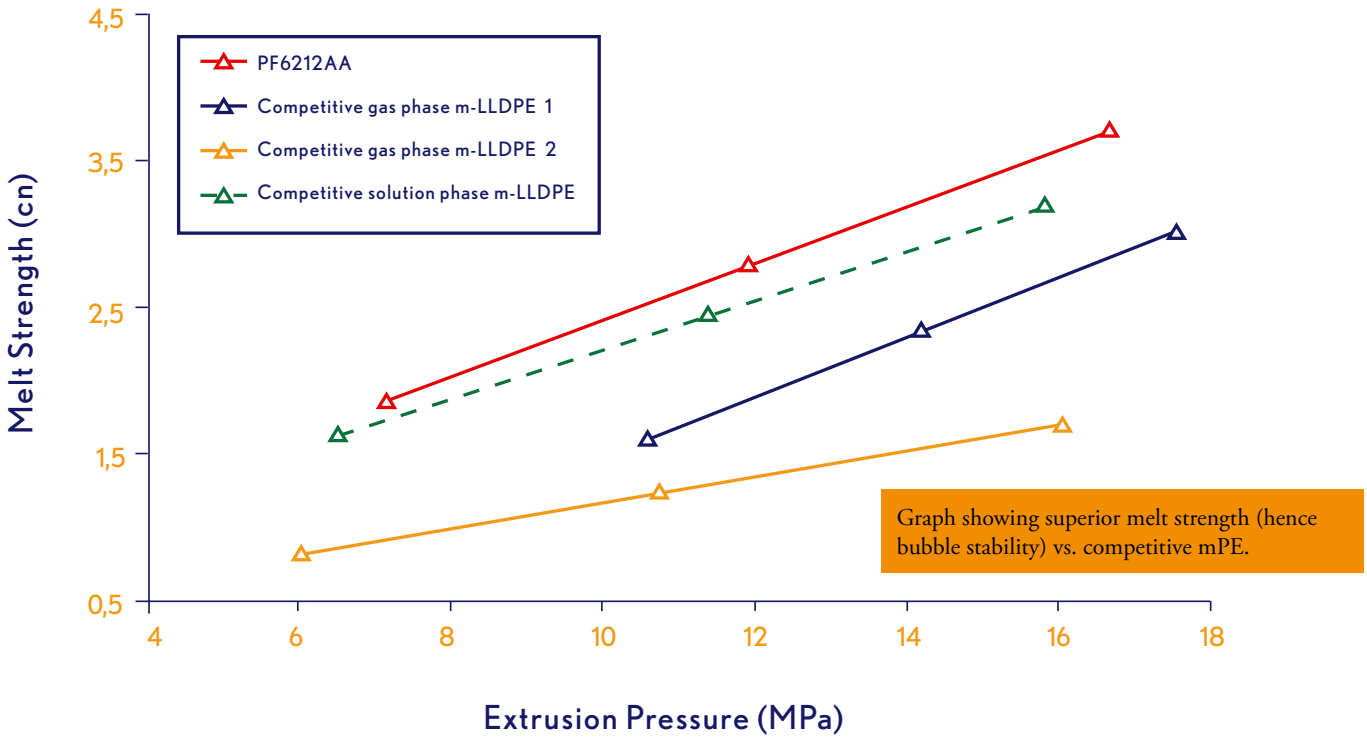
The unique structure of PF6212 series resins (presence of long chain branches) allows for them to be used pure in a layer if wished.

This brings a lot of advantages compared to a typical blend with 10 to 20% of LDPE:

- Mechanical properties are much higher: typically >2500g dart impact vs. 500g for a 20µm film with 20% LDPE blended in
- Possibility to down gauge whilst maintaining high mechanical properties. Economical advantages can be enormous in this case, typically 10% saving (for 50 to 45µm film for example)

Blending with LDPE may however still be an advantage when mechanical properties are sufficient. Optical properties will be (slightly) better and extrusion even easier.

Processability: Melt Strenght vs Pressure at 190°c

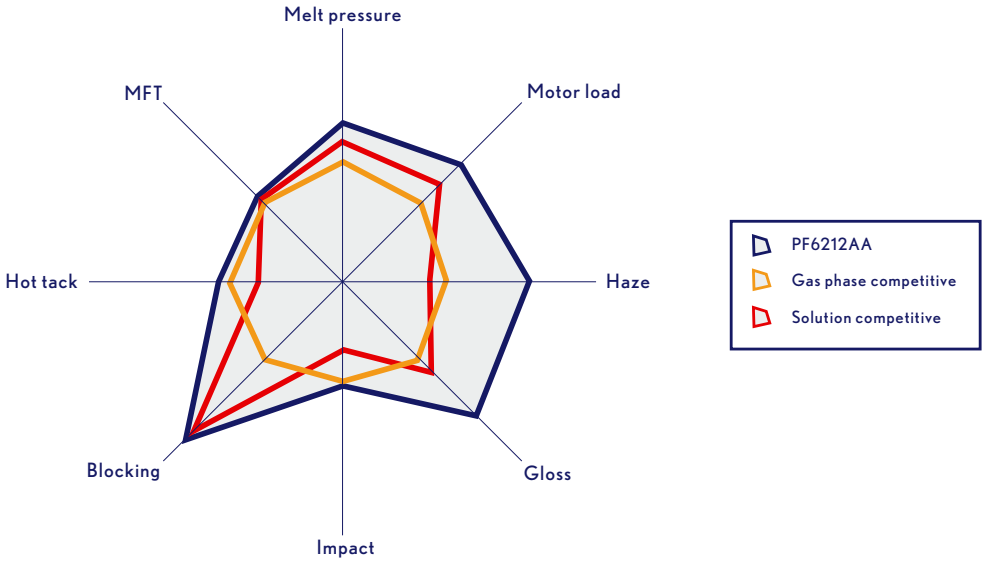


Graph showing superior melt strength (hence bubble stability) vs. competitive mPE.

PF6212 properties vs. other mPE

The following spider diagram summarises the advantages of PF6212 series resins when used pure. The lower motor load and pressure build up due its lower viscosity also allow significant savings either in terms of energy consumption or higher output. As an example we have achieved 20% more output on some extruders compared with other gas phase competitive resins.

For the same output, savings on energy are typically from 5 to 10€/t on the film depending on energy price.



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