DA910 for Masterbatchers.
June 2012
Daiel® DA910: a new PPA designed for the most demanding film applications

and the future will be better...
Polymer Processing Aid (PPA).

– How do they work?
– Daikin product range.
– New generation of PPA : DA910
  • Patented technology
  • Avantages for DA910 in terms of gels
  • Avantages for DA910 in terms of die build up.
– Technical support (labo in Pierre Bénite)
Daiel® PPA’s are based on synergist blends with Fluoropolymers.

Daiel® PPA’s are supplied in powder form.

Daiel® PPA’s are supplied in box of 20 kg.
What is a PPA and what advantages it brings?

- PPA means Polymer Processing Aid.
- Used at ‘homeopathic levels’ < 500ppm, it forms a low adhesion layer (coating) between the metallic surfaces of a production machine (extruder) and the polymer.
- Polymer converters take benefits of PPA.
- Our customer are Resin or MB manufacturers.
Where do we sell PPA?

Polymer Producers

Additive Premix

Convertors

Masterbatch
DAI-EL™: 1st generation of PPA

**DA-310ST** For Cast film and other polymers/technologies

**DA-810 X** For Blow film
DAI-EL™: New generation of PPA

DA-910 for LLDPE and mLLDPE
Improve processing of LLDPE rich blends

Improve processing of HDPE

Reduce wastes

Reduce production costs
DAI-EL™ PPA bring following advantages:

- Eliminate melt fracture
- Improve gloss and reduce haze
- Reduce gels formation during extrusion
- Reduce die build up and die lines
- Have faster colour changes
PPA’s mechanism

Die gap

Film

Die

Die gap
PPA’s mechanism
Velocity profile inside the channel
PPA’s mechanism
Velocity profile outside the channel
PPA’s mechanism
High shear stress zones
LLDPE film produced without DAI-EL™ PPA
PPA’s mechanism
DAI-EL™ PPA Coating
PPA’s mechanism
Velocity profile inside the channel
PPA’s mechanism
Velocity profile outside the channel
Much lower Shear stress
LLDPE film produced with DAI-EL™ PPA
Residence time in an extrusion line
With and without PPA

- Without PPA
- With PPA

Number of particules

0 = Feeding time

PE material creating degraded particules
### DAI-EL™ DA-910 a cost efficient solution

<table>
<thead>
<tr>
<th>PPA grades</th>
<th>Melt fracture elimination</th>
<th>Concentration needed</th>
<th>Mooney viscosity (Dispersion)</th>
<th>Die build up reduction</th>
<th>Risk of Gels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st gen PPA</td>
<td></td>
<td>&gt; 500 ppm</td>
<td>30 - 45</td>
<td>+</td>
<td>Low</td>
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<tr>
<td>DA-310ST</td>
<td></td>
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<tr>
<td>DA-810X</td>
<td></td>
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</tr>
<tr>
<td>Competitor</td>
<td>+</td>
<td>&gt; 300 ppm</td>
<td>65 - 80</td>
<td>-</td>
<td>High</td>
</tr>
<tr>
<td>2nd gen PPA</td>
<td></td>
<td>&gt; 500 ppm</td>
<td>30 - 45</td>
<td>+</td>
<td>Low</td>
</tr>
<tr>
<td>No Daikin PPA</td>
<td>+</td>
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<tr>
<td>Competitor</td>
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<tr>
<td>New gen. PPA</td>
<td>+</td>
<td>&gt; 300 ppm</td>
<td>30 - 45</td>
<td>+</td>
<td>Low</td>
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<tr>
<td>DA-910*</td>
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</table>

* Low Mooney viscosity functionalized fluororubber.
Dispersion Verification: Hotplate microscope
Drop size comparison

1st gen. : DA 810X

2nd gen. : competitor

New gen. : DA 910

Scale: 20 microns
Capillary rheometer coating curves and die build up
Pressure drop at 500 ppm PPA in LLDPE

Pressure (bars)

LLDPE C4 0.7 MFI 0.925 D

Time (mn)

1st gen. DAI-EL DA810X
New gen. DAI-EL DA910
Pressure drop at 300 ppm PPA in LLDPE

LLDPE C4 0,7 MFI 0,925 D

Pressure (bars)

Melt fracture elimination

2\textsuperscript{nd} gen. competitor B
New gen. DAI-EL DA910

Time (mn)
Melt fracture elimination tests
Melt fracture elimination tests on LLDPE blown film

Blown film trial:
LLDPE C4 (MFI 0.7 & density 0.925)

- DA910 at 300 ppm
- DA810 at 500 ppm

% Melt fracture vs. Time, min
Melt fracture elimination tests on LLDPE blown film at 250 ppm of PPA

<table>
<thead>
<tr>
<th>New generation: Daikin DA910</th>
<th>2,5 min</th>
<th>2nd generation: competitor</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>5 min</td>
<td></td>
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<tr>
<td></td>
<td>7,5 min</td>
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<td></td>
<td>10 min</td>
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<td></td>
<td>12,5 min</td>
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<td></td>
<td>15 min</td>
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<tr>
<td></td>
<td>17,5 min</td>
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<tr>
<td></td>
<td>20 min</td>
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</table>
Die build up during fast coating - 2500 ppm (20mn)

1st gen. DA 810X

2nd gen. competitor

Strong DBU + die lines

New gen. DA 910
Importance of fine dispersion of PPA for blown film applications.

- Gels are coming from the degradation of PE.
- Cross-linked Polymer that behaves like a thermo set. Creates a hard particule inside the film.

- For lamination films, risk to damage the barrier layer.
- For HQ printing, risk to damage the rubber rolls and have defects in printing (fish eyes).
- Surface protection: risk of visible impact marks on the support (metal).
Conclusion regarding DAI-EL™ DA 910

- **Drop size** equivalent of 1\textsuperscript{st} generation even when compounded in LDPE

- **Die build up** as good as 1\textsuperscript{st} generation PPA and better than 2\textsuperscript{nd}

- **Faster coating and melt fracture elimination** than 1\textsuperscript{st} generation PPA

- **Universal PPA** that enables the definitive replacement of 1\textsuperscript{st} and 2\textsuperscript{nd} generation.
1\textsuperscript{st} generation customers: DA910 enables a cost reduction without compromising the final quality. (gels and die build up)

2\textsuperscript{nd} generation customers: DA910 enables to significantly reduce the gel level and offer superior die build up elimination.

1\textsuperscript{st} and 2\textsuperscript{nd} generation customers: DA910 enables to rationalise the PPA masterbatch.
Thank you