

A novel processing stabilizer with enhanced hydrolytic stability

International Polyolefins Conference 2017, "Convergence of Technology and Markets"

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Confidential

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13.02.2017

what is precious to you?

AddWorks

Innovative polymer additives solutions



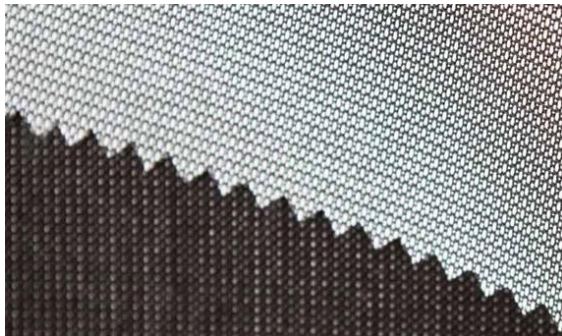
PACKAGING



AUTOMOTIVE & TRANSPORTATION



AGRICULTURE



TEXTILE & FIBERS



INDUSTRIAL BUILDING & CONSTRUCTION

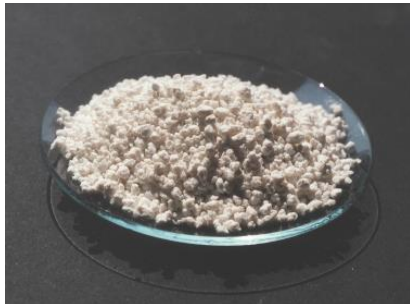
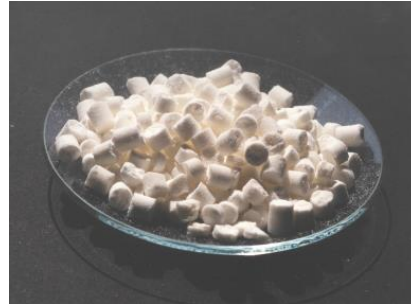


COATING

Table of Contents

- AddWorks Solutions
- Extrusion Process - Benefits of AddWorks LXR (əɪksɪr) 568
- Evaluation of hydrolytic stability
- AddWorks LXR 568 - Adding values for high speed BOPP
- Cost efficient solutions for LLDPE processing - Benefits of AddWorks LXR 568

AddWorks Solutions



- A unique combination of a differentiated chemical formulation offered in the most-convenient-to-handle physical form.
- Solutions developed by Clariant Polymer Additives to satisfy specific market needs.
- By leveraging on Clariant's products, expertise, know-how, production capabilities, AddWorks remove complexity and cost at our customers.

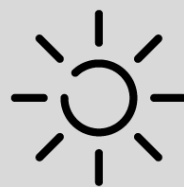
Solution nomenclature

Commercial products – Product oriented solutions

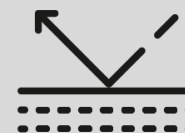
AddWorks LXR



2 ACID SCAVENGERS



3 UV/LIGHT STABILIZERS



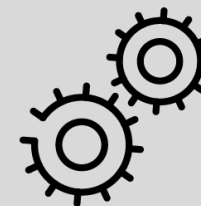
4 SURFACE EFFECTS



5 ANTIOXIDANTS



6 POLYMERIZATION AGENTS

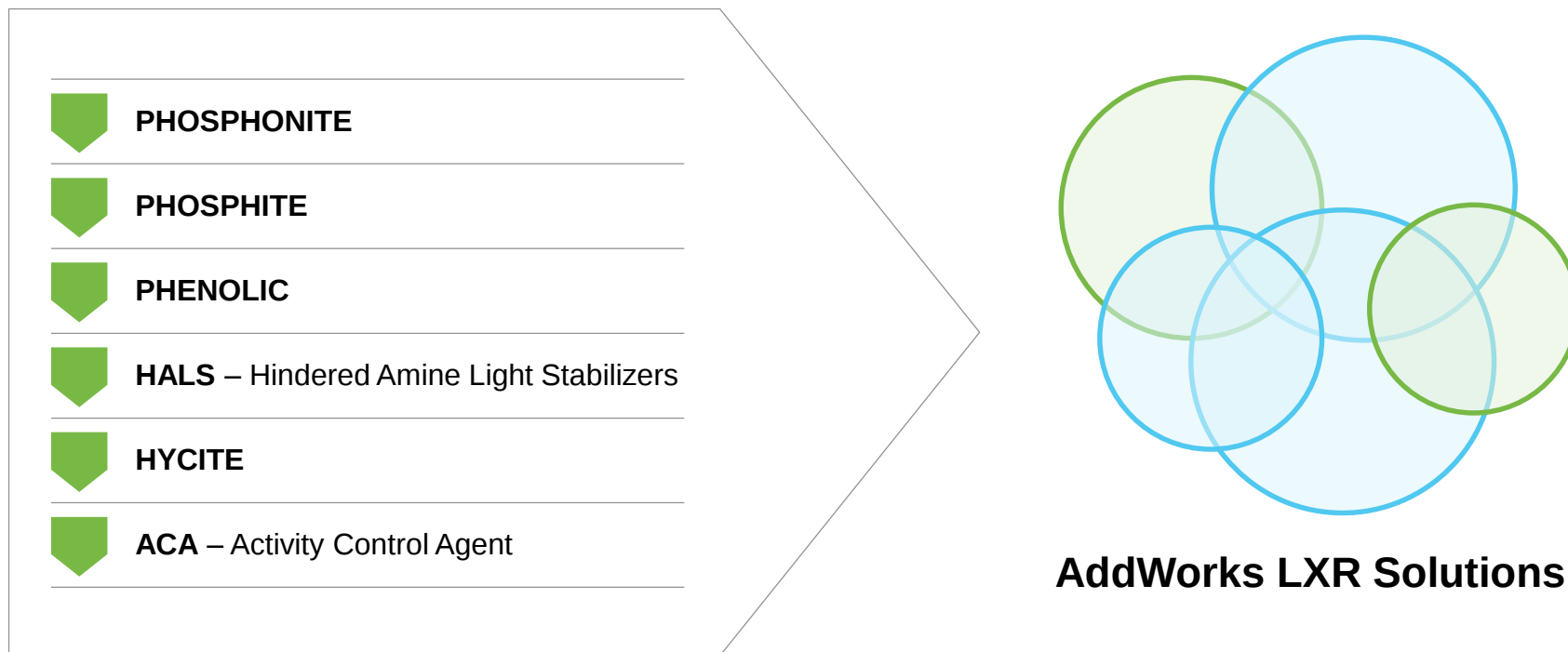


7 PROCESS STABILIZERS

The full AddWorks Picture

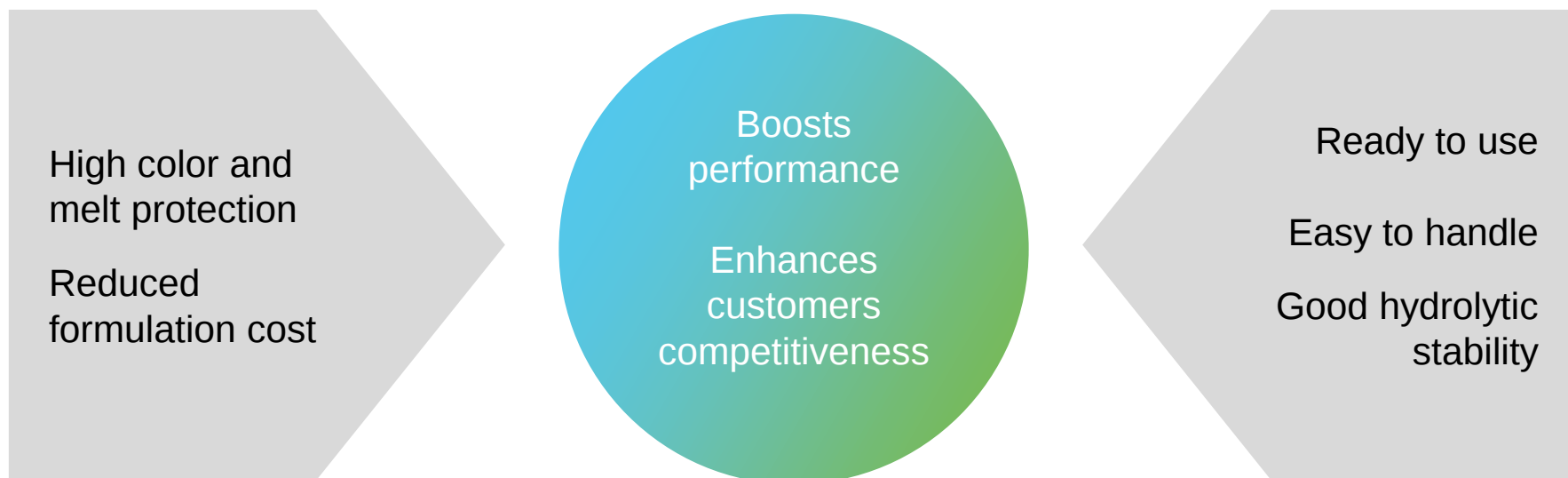


Fully integrated manufacturing process to enhance customer performance



AddWorks LXR solutions are the result of the unique integrated additive **manufacturing competence** at Clariant. This concept beyond blends provides **unique additive performance** for **polymeric resins**.

AddWorks LXR 5 series – specific designed solutions



Cost efficient MFR
Color protection of polyolefins
Numerous **additional benefits.**

Fully integrated approach to provide customer specific performance



Low migration



Superior colour



Low gel formation



Enhanced metallisation



Enhanced melt stability



Low water carry over



In-process cleaning



Excellent hydrolytic stability



Enhanced pressure pipe life-time



Cost efficiency



Outstanding UV performance

AddWorks LXR 5 series solutions



Customer specific benefits in a **fully integrated** way.

AddWorks LXR 568

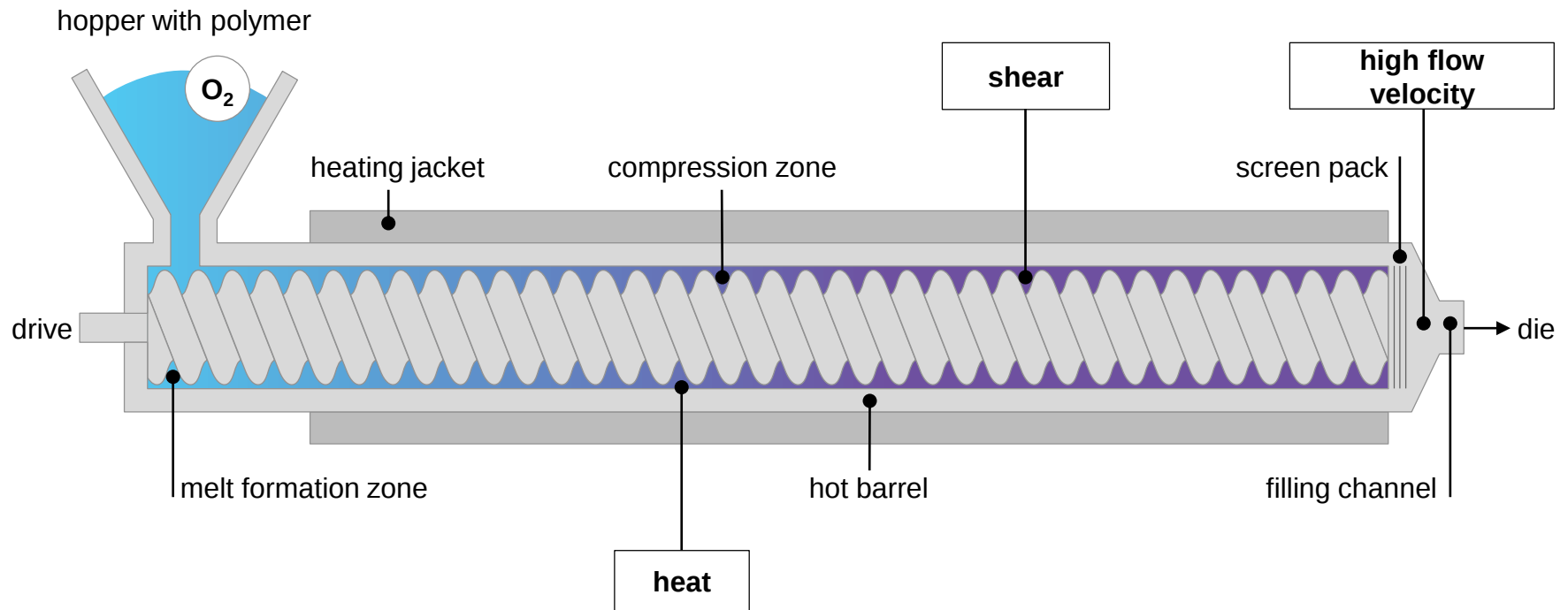
BENEFITS FOR EXTRUSION PROCESS

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what is precious to you?

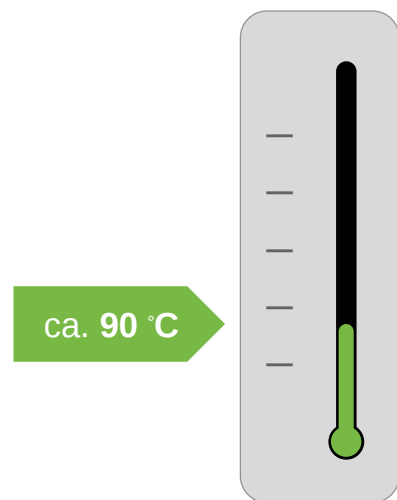
Melt formation and extrusion



Several **critical zones** for polymers in the **extrusion process**

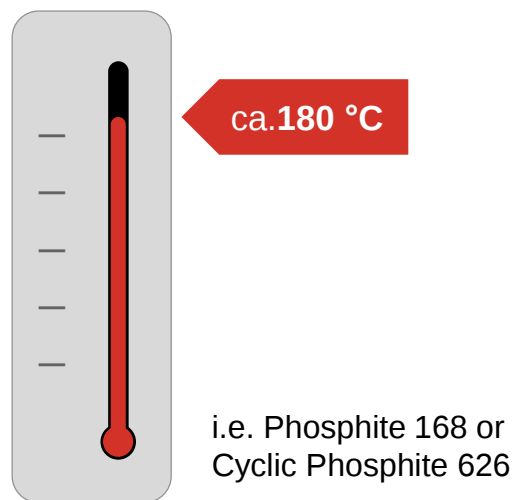
Addworks LXR 568 is activated early during plastic processing and efficiently protecting the resin melt

Softening temperature interval
AddWorks LXR 568



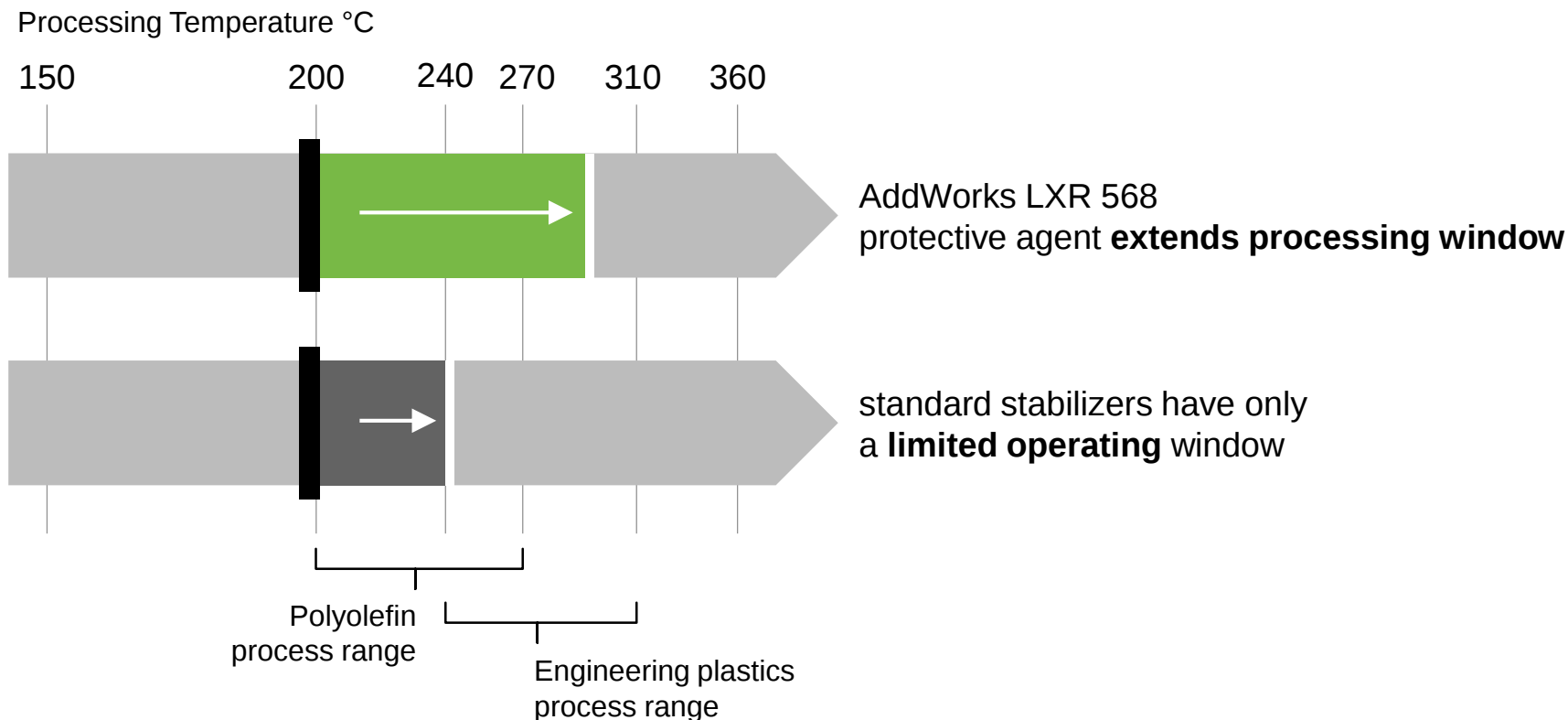
See the
difference

Typical melting point of
single stabilizer



The low melting temperature of AddWorks LXR 568 contributes to a superior **melt homogeneity** and an efficient **reduction of gels and defects** in films.

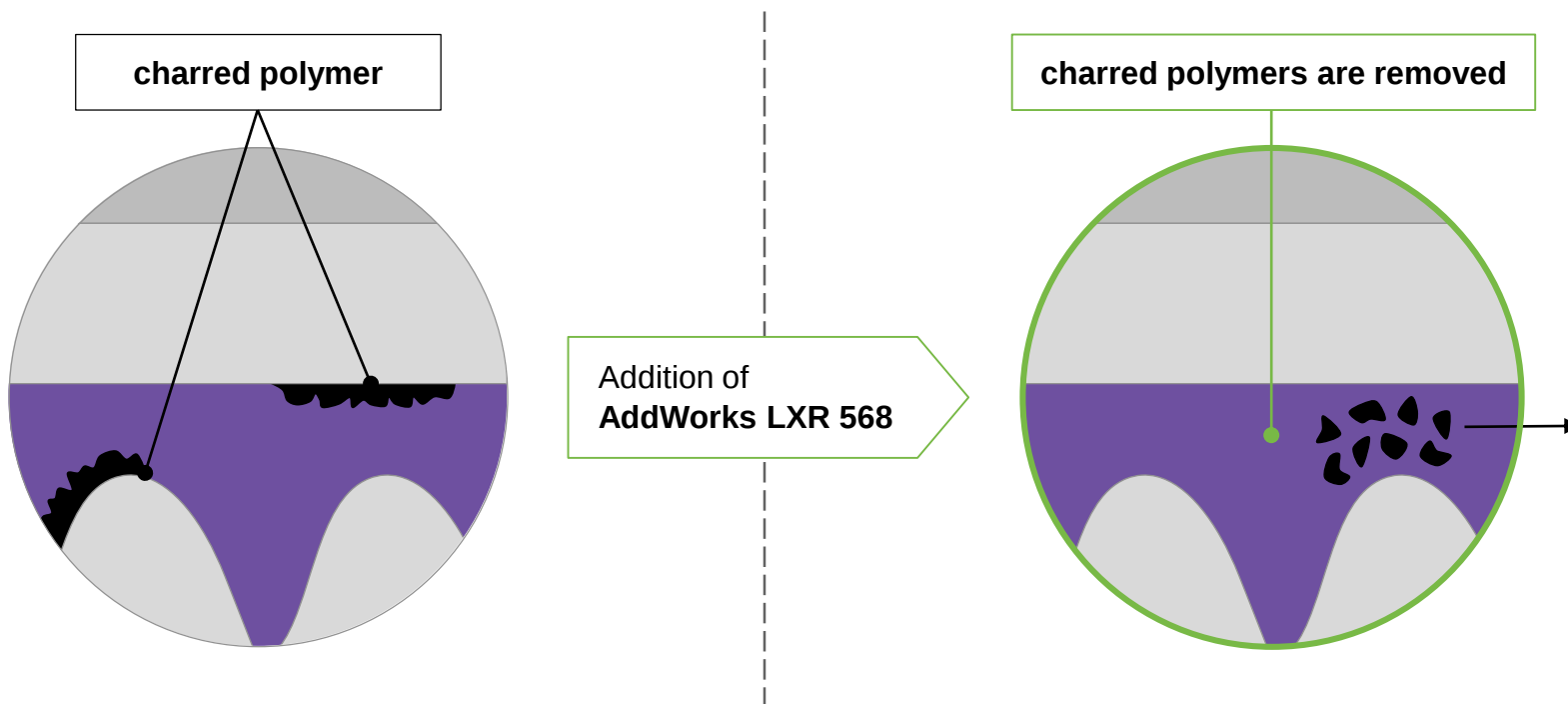
Performing in an extended range of situations



The combined high heat stability and high efficiency of AddWorks LXR 568 allow to:

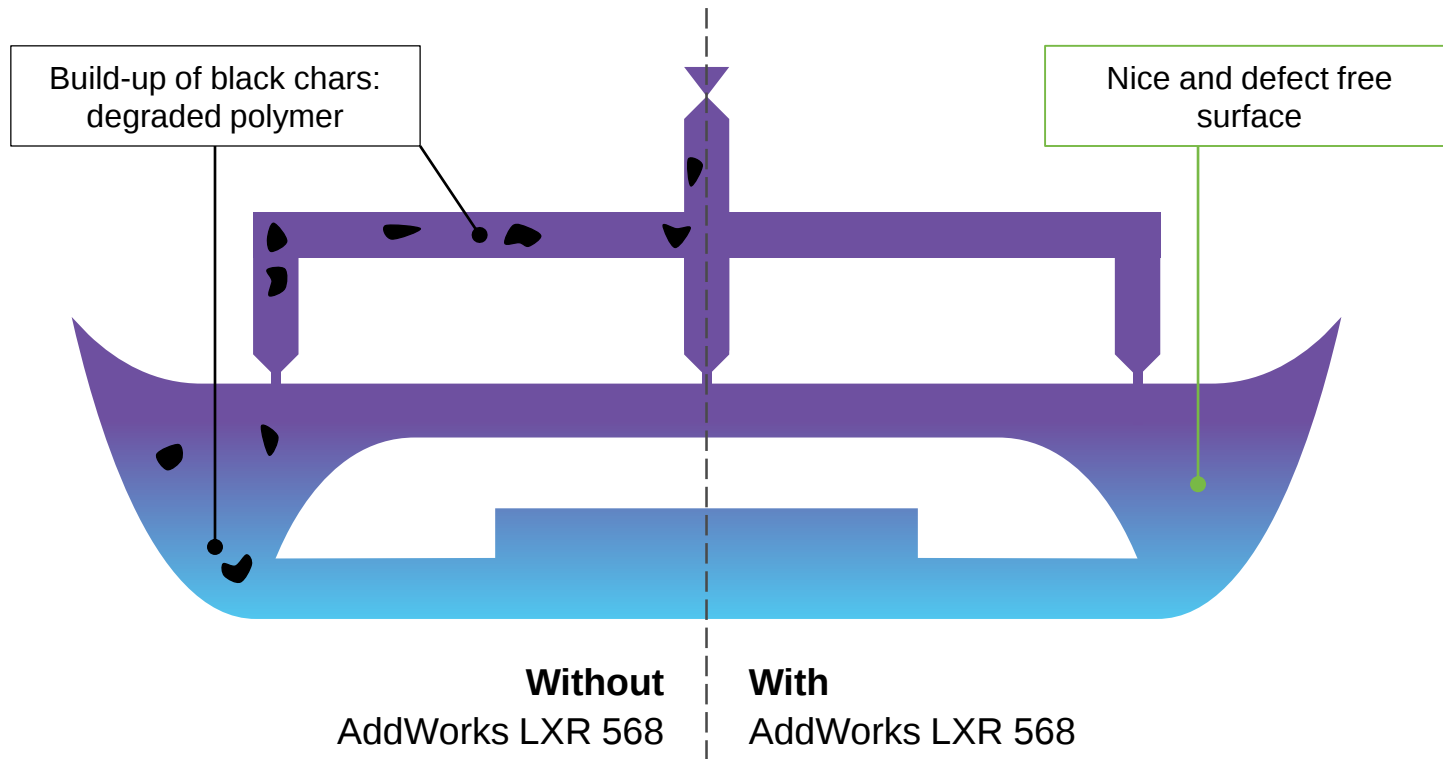
- Efficiently **stabilize** a broad range of resins, including high temperature polymers
- Boost productivity with **higher processing temperatures**

Effectively cleaning machines without disassembling production lines



AddWorks LXR 568 reduces maintenance costs, cleaning costs and machine downtime by achieving a very effective **cleaning** of metal surfaces without disassembling extruders

Preventing surface defects on injected molded parts



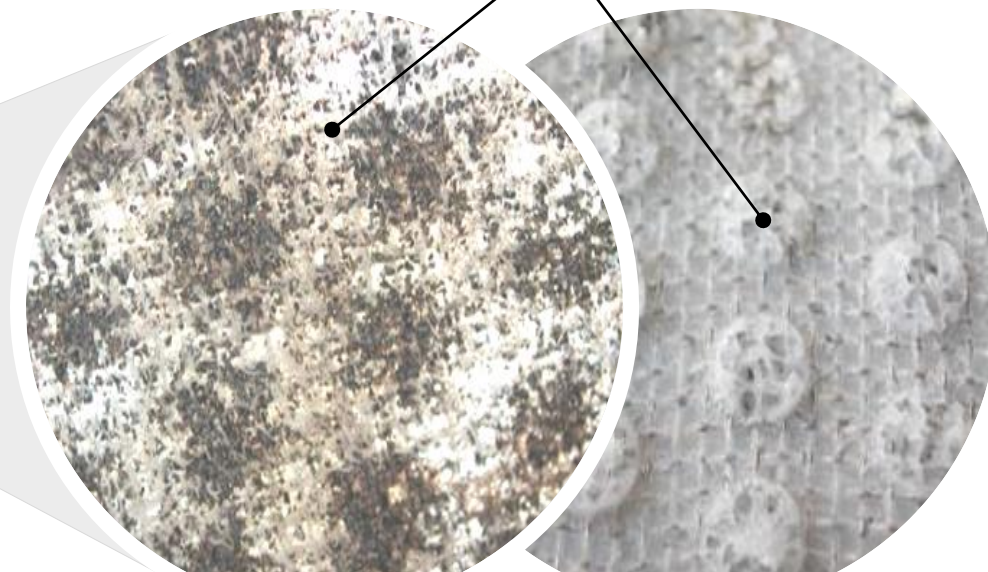
Whilst using AddWorks LXR 568 **build up of chars** in the hot runner could be **prevented** and **nice surface appearance** of moulded part without any defects ensured

Preventing filter clogging in extrusion

WITHOUT ADDWORKS LXR 568
PARTICLES ARE FORMED INTENSELY



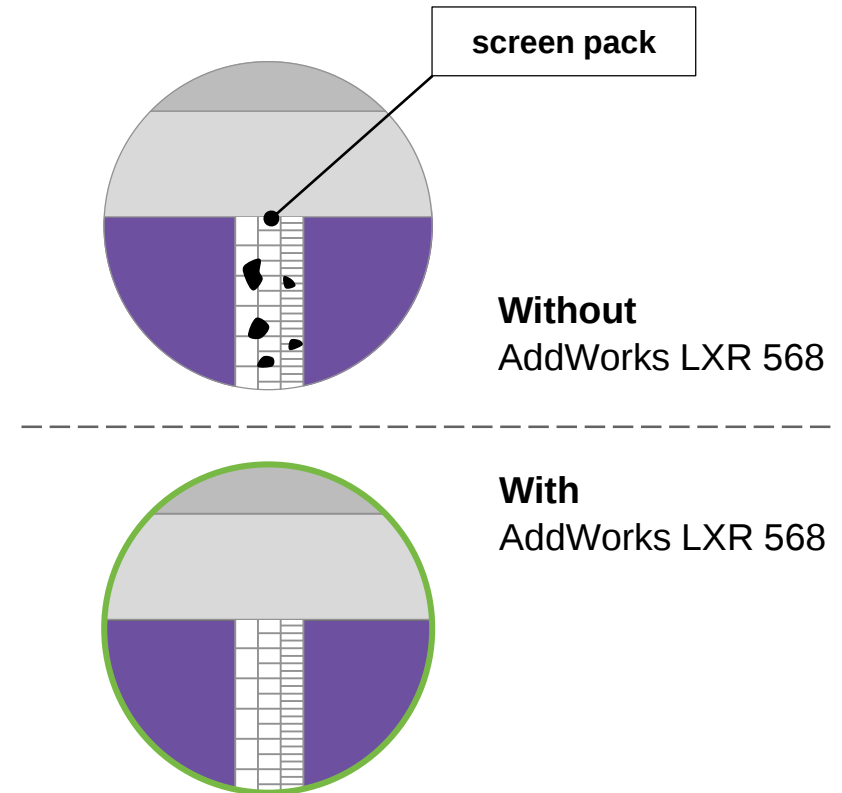
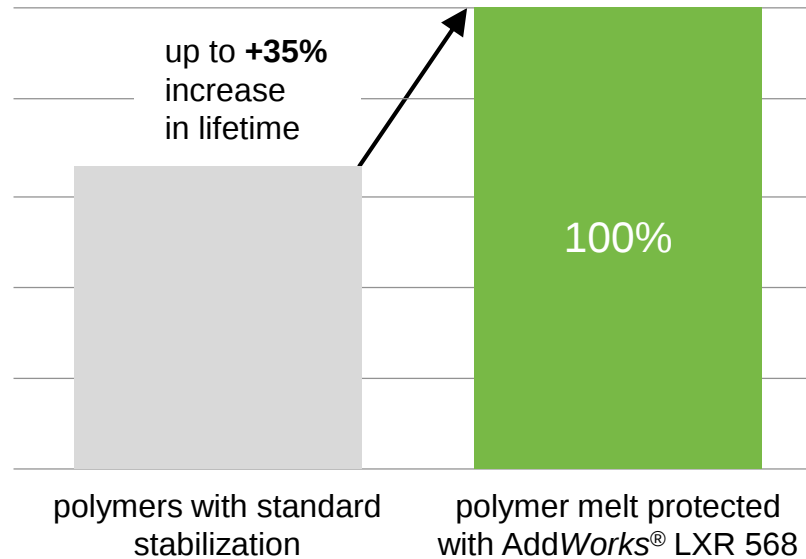
Particles are clogging
the filters rapidly



Very **short** screen pack **lifetime**.
Very **short maintenance** intervals.

Extended life time of extruder screen pack

LIFETIME



Utilizing AddWorks LXR 568 **extend screen pack lifetime** significantly
Long maintenance intervals and **lower costs**

AddWorks LXR 568

EVALUATION OF HYDROLYTIC STABILITY

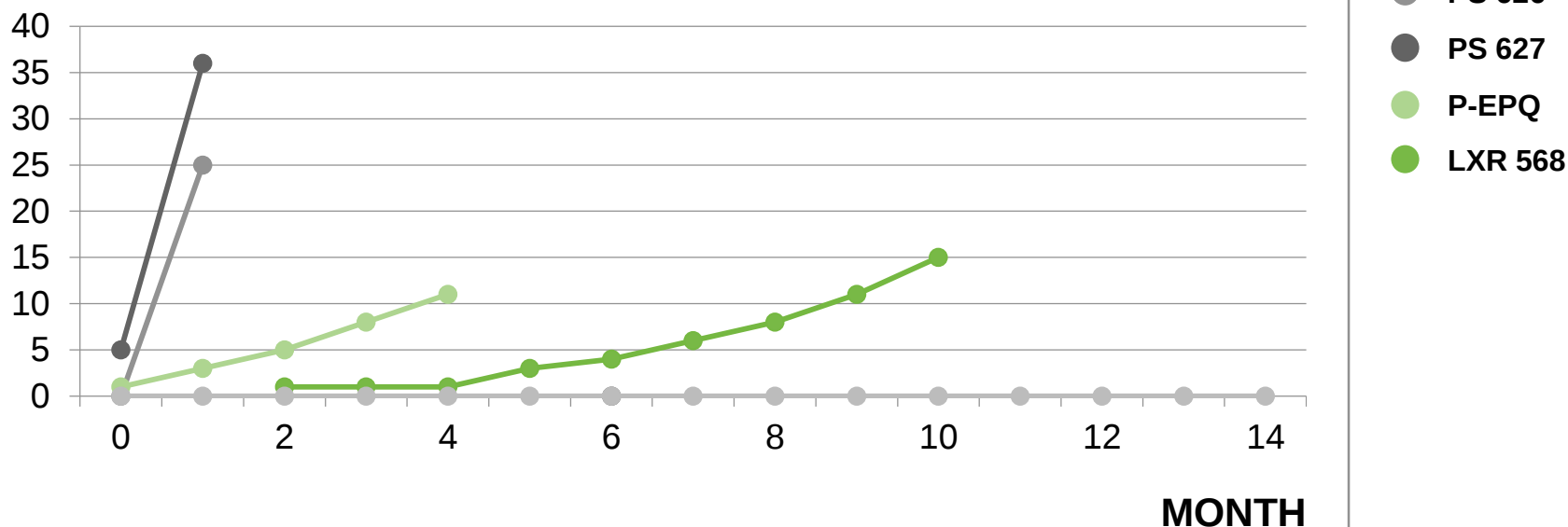
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Hydrolysis Stability in PE Zip Bag

DTBP CONTENT (%)



Significant **higher hydrolytic stability** vs specialty phosphites

AddWorks LXR 568

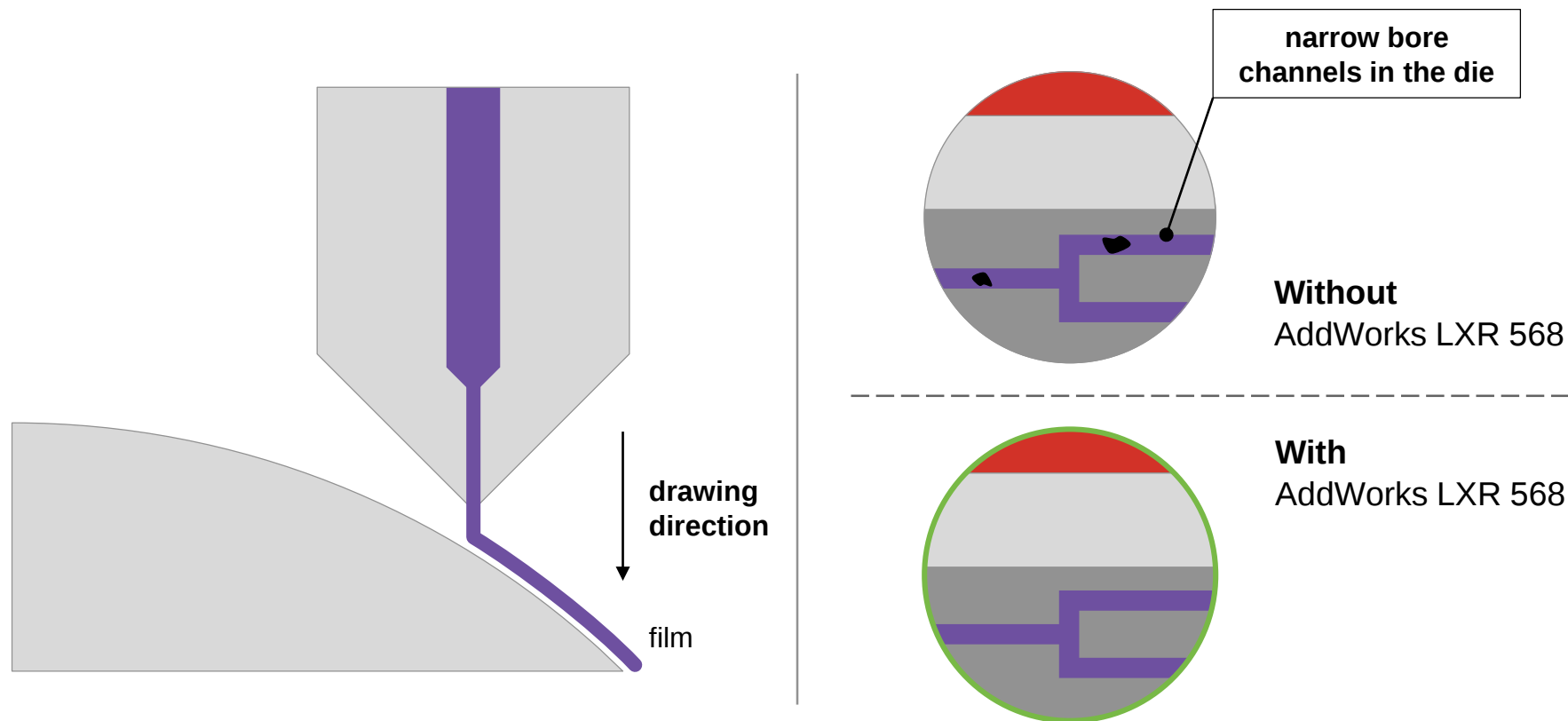
ADDING VALUE TO HIGH SPEED BOPP

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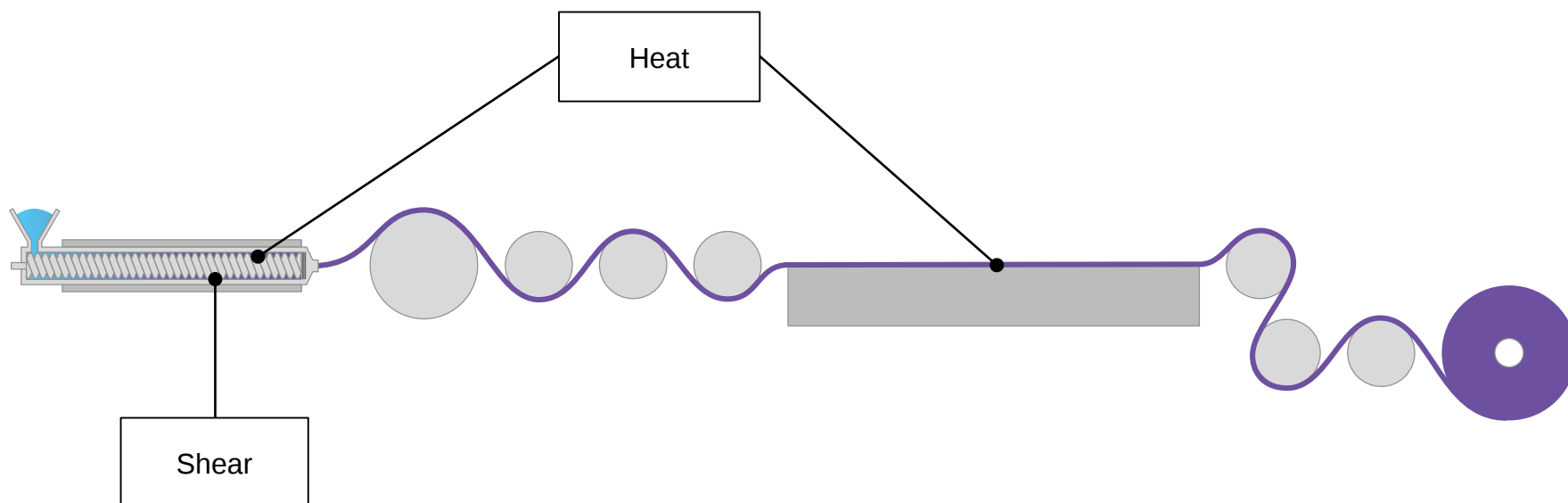
what is precious to you?

AddWorks LXR 568 and cast film extrusion



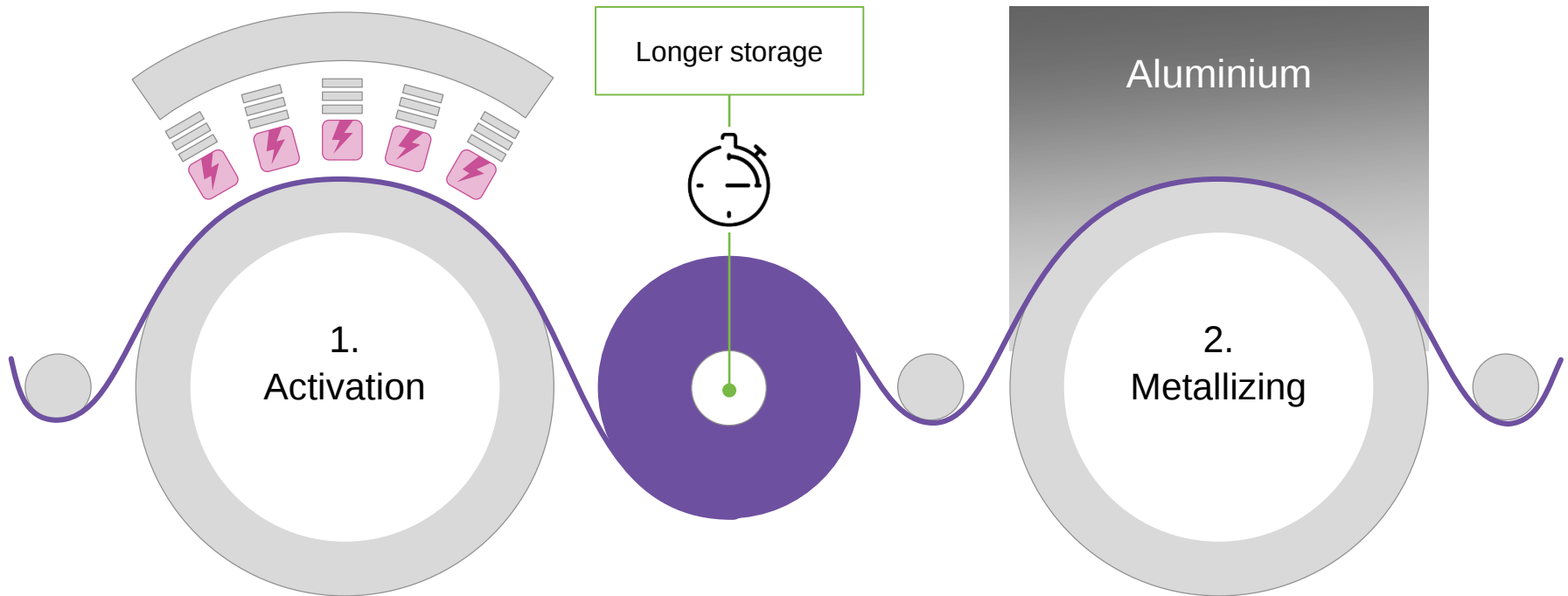
Utilizing AddWorks LXR 568 **extend screen pack lifetime** significantly
Long maintenance intervals and **lower costs**

Critical steps of BOPP film extrusion



AddWorks LXR 5xx solutions help to control degradation attacks throughout the entire process.

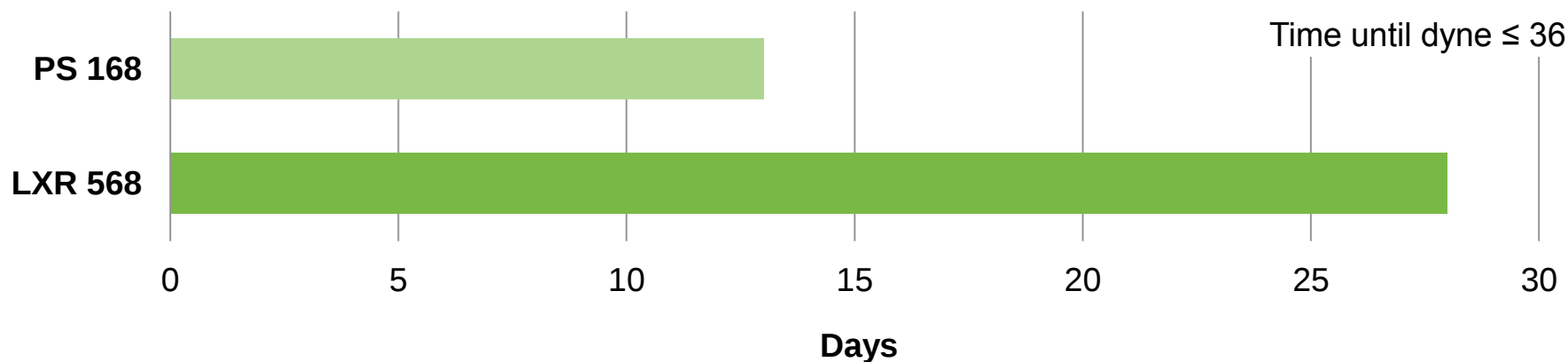
Critical steps of BOPP Corona Treatment Metallizer



Low Migration and excellent Dyne level retention

Corona treatment of PP film grade: Better Dyne level retention

INITIAL DYNE LEVEL AFTER CORONA TREATMENT: 52 DYNE/CM



BAD

GOOD

Base stabilization: Hycite 713, AO 1010, Film Thickness 50 μm

Significantly better dyne retention

Materials and Formulations evaluated

RESIN

- BOPP
- MFR=2.0

ADDITIVES

- Hycite 713
- AO 1010
- PS 168
- AddWorks LXR 568

FORMULATIONS

- Base: 300 ppm Hycite 713, 500 ppm AO 1010
- Base + 700 ppm P-EPQ
- Base + 700 ppm AddWorks LXR 568

Experiment processing conditions

MIXING WITH LOW SPEED MIXER

- Polymer
- Additives

COMPOUNDING PRE-EXTRUSION @ 210°C

- Pass 0

MULTIPLE EXTRUSION @ 270°C

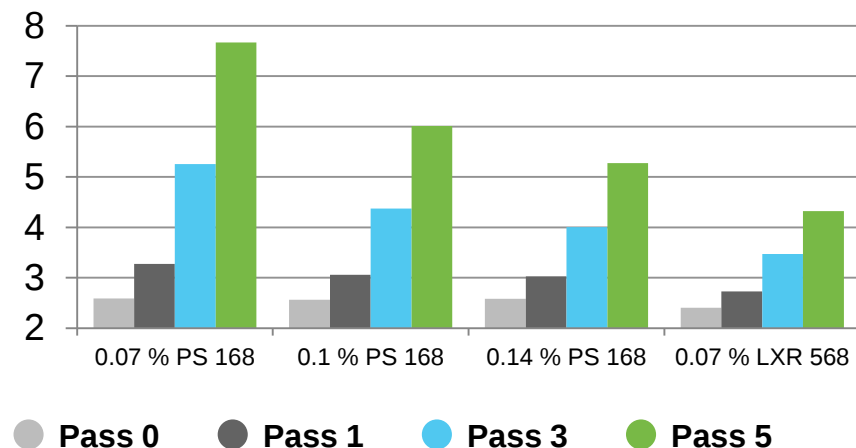
- Pass 1
- Pass 3
- Pass 5

FILM BLOWING

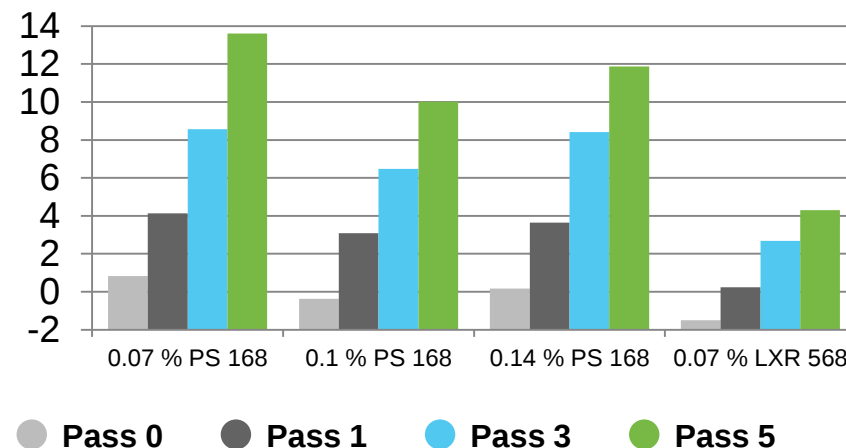
- Thickness: 30 microns
 - Temp: 210°C – 250°C
-

High Processing stability for BOPP film grade

MFR 230 °C / 2.16 KG (G/10MN)



YELLOWNESS INDEX



BAD ← → GOOD

BAD ← → GOOD

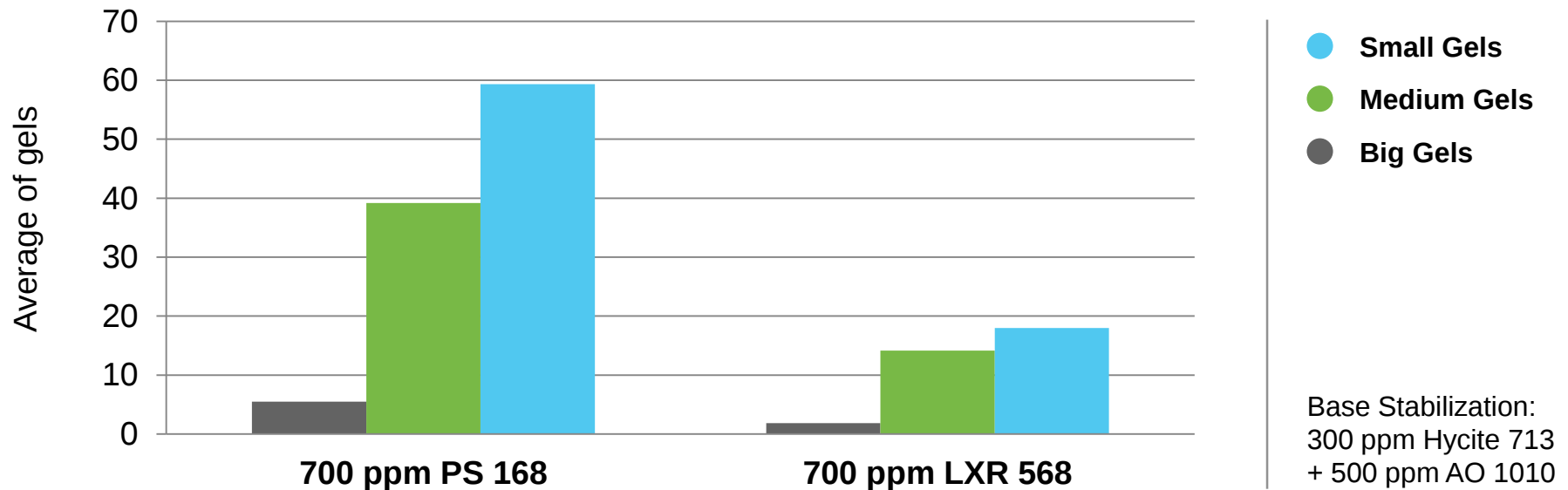
Base Resin: BOPP, MFR = 2.0; Base Stabilization: 300 ppm Hycite 713 + 500 ppm AO 1010

44 % better MFR protection than PS 168
68 % better color protection than PS 168
No color improvement by increasing concentration of PS 168

Additive loading can be reduced by a factor of 2 to 3
Less plate out, less blooming, less die built-up

Film Defects – Gel result

GELS COUNTED



AddWorks LXR 568 reduces the number of gels by **67%**

Conclusion

AddWorks LXR 568 gives 44 % better MFR protection than PS 168

AddWorks LXR 568 give 68 % better color protection than PS 168

Consequently the additive loading can be reduced by a factor of 2 to 3

AddWorks LXR 568 reduces the number of gels by 67%

AddWorks LXR 568 provides superior resin protection

Cost efficient solutions for LLDPE processing

BENEFITS OF ADDWORKS LXR 568

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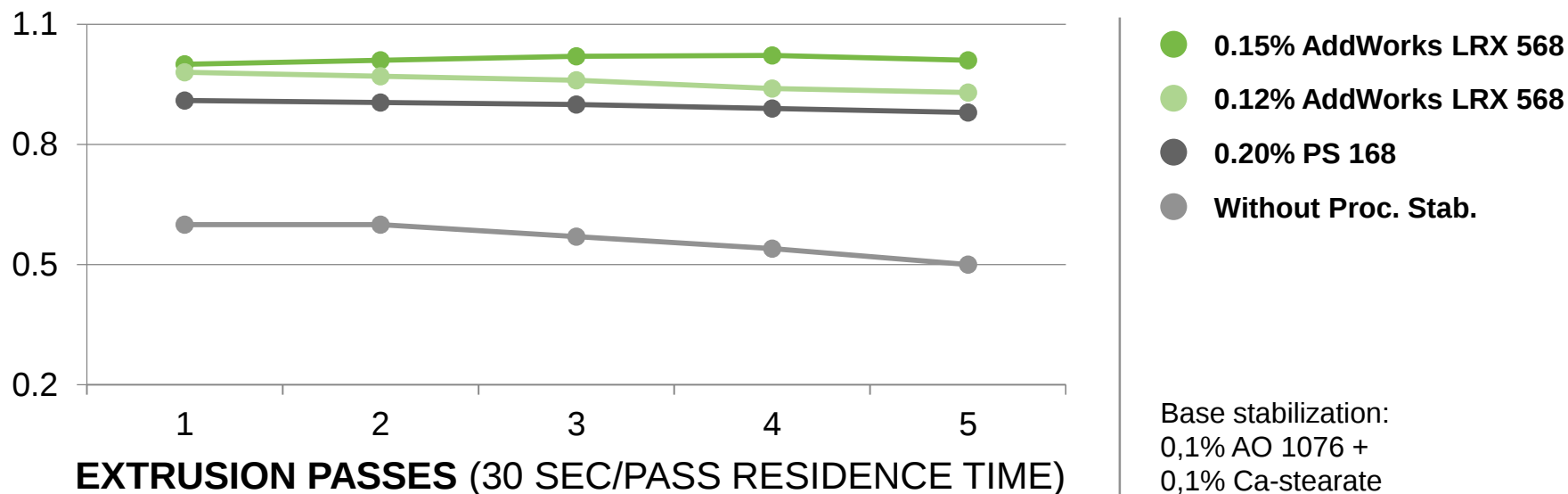
General requirements for film



- Melt and color stability
- High transparency
- Low gels
- Even film thickness profile

Processing of LLDPE (0,918 g/cm³) at 240°C

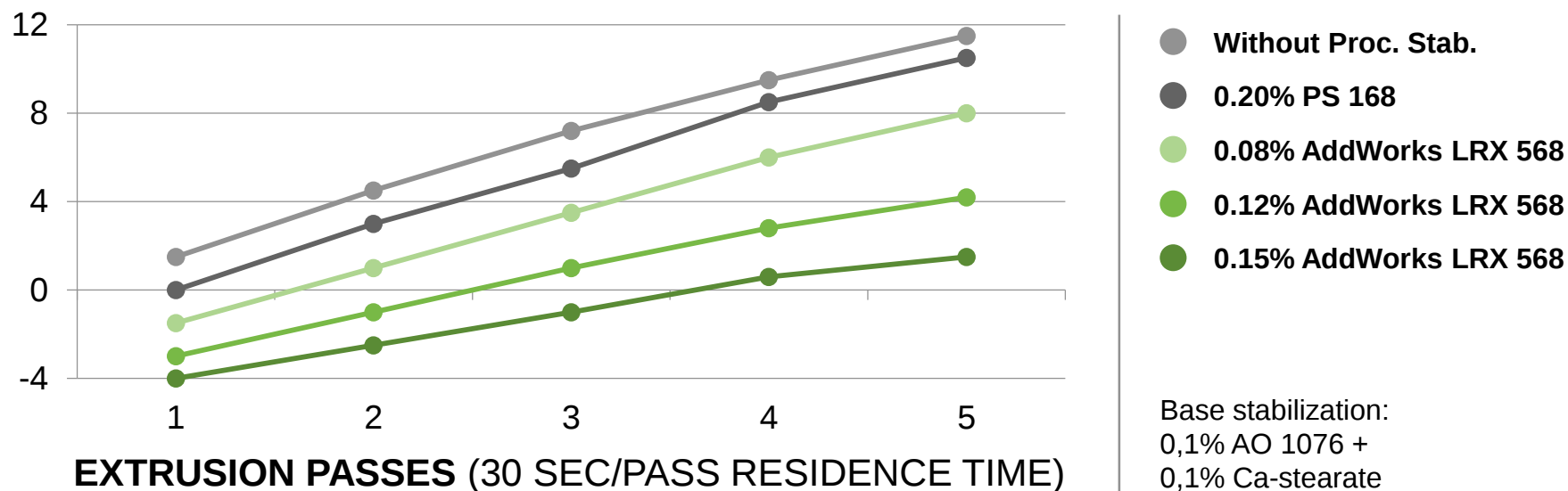
MELT FLOW INDEX (MFI, 190°C/2,16 KG) [G/10MIN]



Superior **MFR retention of LLDPE** stabilized with solutions based on AddWorks LXR 568

Processing of LLDPE (0,918 g/cm³) at 240°C

YELLOWNESS INDEX (PELLETS)

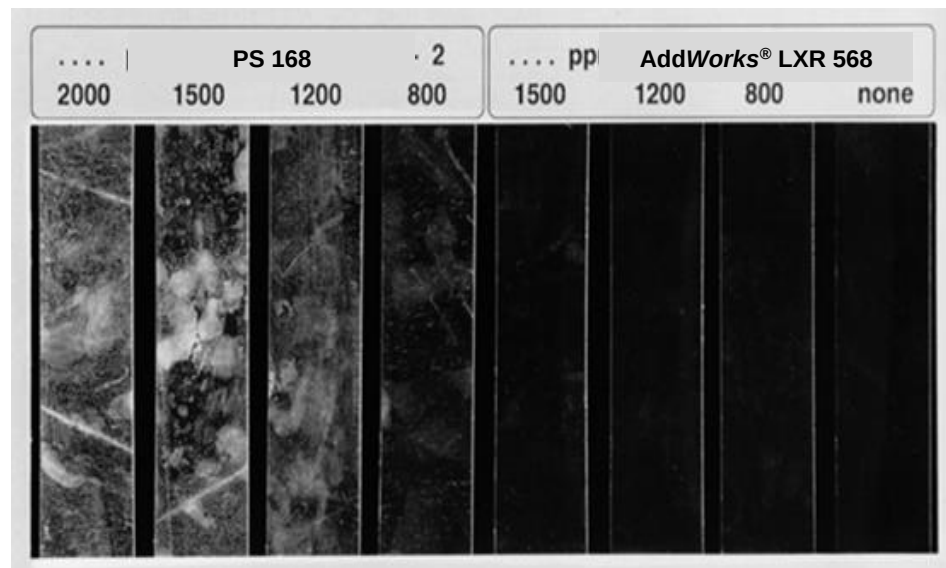


Outstanding **YI protection for LLDPE** stabilized with solutions based on AddWorks LRX 568

Reduced blooming of LLDPE film

LLDPE FILM SAMPLES
(DENSITY = 0.917 G/CM³)
AFTER 1 YEAR STORAGE
AT 23 °C (73 °F)

Additive formulation:
200 ppm AO +
Processing Stabilizer



Strong exudation / "blooming"

Excellent solubility of AddWorks LXR 568 in LLDPE
High transparency / No blooming
Nonyl-Phenol free solution

AddWorks LXR 568

PRODUCT FORM

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Product Form

ADDWORKS LXR 568 MP



AddWorks LXR 568 is **available as free flow, dust-free micro pills.**