HALOBUTYL TIRE INNER LINERS
Problem Solving Guide

PROBLEM
POSSIBLE CAUSES
POSSIBLE REMEDIES

1) Undispersed lumps of polymer
1) Incorrect batch size.
2) Polymer too cold.
3) Oil added too early.
4) Internal mixer too hot.
5) Premixation.
6) Other.
1) Ensure internal mixer is full. Ram should seat just before dump. Check by adding 5 kg pieces of base stock and observe behavior of ram.
2) Bring polymer to 60ºF (15ºC). Store skids at least 2 weeks at required temperature or break down the skid and leave bales on trays for 24-hours.
3) Adjust oil addition timing.
4) Check Temperature Control Unit and ensure proper cooling.
5) Add filler with the polymers.
6) Use lower Mooney version of polymer.

2) Slow mixing
1) Incorrect batch size.
2) Oil added too late.
3) Slow black incorporation.
1) See 1.1.
2) Adjust time of all additions.
3) Check calibration of mixes.
- Add wetting agent (e.g. Stearic Acid) at start of cycle.

3) Scorching
(> a two-pass mix)
1) Dump temperature too high.
2) Ingredients causing scorch.
3) Polymer/black scorch in first-pass mix.
4) Polymer unstable.
1) Check mixer thermocouple.
- First-pass 135ºC max for BIIR.
- First-pass 145ºC max for CIIR.
- Second-pass 110ºC max.
- Increase cooling, reduce rotor speed.
2) Check ingredients:
- Acidic materials reduce scorch time of HIIR.
- Basic materials increase scorch time of HIIR.
- Amine antioxidants and antiozonants reduce scorch in HIIR.
3) Add MBTS in first-pass mix.
4) Check for polymer stability e.g., check Mooney viscosity.

4) Compound sticking (see also A.3)
1) Compound ingredients.
2) Mixing and/or processing temperatures too high.
3) Adding zinc oxide in first-pass mix.
4) Slab-cuts may contain zinc stearate.
1) Review all compounding ingredients.
- See A.3.2.
- Phosphoric acids, wood resins, aromatic oils reduce time to scorch.
- Avoid using amine, quinone type antioxidants/antiozonants in CIIR compounds.
2) See A.3.1.
3) Mix zinc oxide to final mix.
4) Eliminate zinc as it is a curing agent for HIIR.

5) Insufficient tack
1) Additives migrating to the surface (i.e. blooming).
2) Contamination on the surface of the calendared sheet.
3) Excessive tension when rolling up inner liner into the storage interleaving material – can result in an impression on the inner liner.
4) Compound Mooney too high.
5) Compound partially scoured.
1) Reduce or eliminate materials which could be migrating (aromatic oils, fatty acid esters, wax, sulfur).
- Use cooling drums or metal belt to cool inner liner to ambient temperature immediately after calendering or extrusion to retard surface migration.
- Lower compound temperature on the calendared rolls.
2) Clean or replace the liner roll interleaving or separating material.
- Clean cooling equipment.
3) Reduce tension when rolling up the inner liner into the interleaving material.
- Optimize compound Mooney.
4) Check T emperature Control Unit and ensure proper cooling.
5) Add oil if Possible or use lower Mooney-HIR.
6) See B.1.

6) Sticking to metal
1) Compound Mooney too low.
2) Too much tackifier.
3) Other.
1) If possible increase filler level or reduce oil level.
- Adopt higher Mooney version of HIR.
2) Decrease tackifier level.
3) Avoid use of untreated clays.
- Check all weighing system.
- Check Temperature Control Unit for mixer body, door and motors.

7) Sticking to mill or calender rolls
1) Mill or calender roll temperatures.
1) Adjust temperature:
- HPR's tend to follow cooler roll.
- Stickness usually least when mill/calender roll at 50ºC.
- Check cooling circuit for fouling.

8) Shrinkage of calendared sheet
1) Compound shrinkage.
2) Poor calendering.
3) Excessive stretching or pull-down.
4) High compound viscosity.
1) See B.1.
2) Improve cooling prior to windup.
3) Reduce tension in windup equipment.
4) Adjust lower mooney version of HIR.
- Decrease compound Mooney.

9) Blister within plys
1) Air in the mixer is incorporated in the compound and not removed.
2) Air trapped in calender feed strip.
1) Check to ensure optimum batch size (See A.1). Check alignment of consolidation roll.
- Check hardness of consolidation roll. Replace or cover with fabric or sponge rubber.
- Decrease consolidation roll diameter.
- Increase consolidation roll pressure.
- Increase compound viscosity.
- Use high angle (> 14º degrees) when ply-lifting conserves.
2) Increase tack (See B.2).

10) Blister between plys
1) Poor consolidation.
1) Check alignment of consolidation roll.
- Check hardness of consolidation roll. Replace or cover with fabric or sponge rubber.
- Decrease consolidation roll diameter.
- Increase consolidation roll pressure.
- Increase compound viscosity.
- Increase high angle (> 14º degrees) when ply-lifting conserves.
2) Poor tack.

11) Inner liner splitting (after expansion radial time)
1) Curscopic splitting.
1) Improve the green strength of the carcass compound. (Increase the N.R. content).
- Reduce the expansion (or I.R).
- Eliminate “missing” cord material.

12) Inner liner splitting (after expansion radial time)
1) Insufficient tack.
2) Excessive compound shrinkage.
3) Other.
1) See B.2.
2) See B.5.
3) Use splintering.

13) Inner liner thinning (except compound flux)
1) Excessive stretching during ‘green’ tire assembly.
2) Adding “new” material at the calendered feed mill.
3) Excessive sticking to calendared inner liner interleaving material.
4) Insufficient rubber in the tire shoulder area.
5) Tire construction parameters.
1) Reduce stretching of inner liner. Check assembly drum speed and let-off braking mechanism.
2) Add “new” material at the internal mixer (second-pass only).
3) See B.2.3.
4) Increase rubber in tire shoulder area.
5) Decrease carcass tension.
- Add NR gum strips to liner in the tire shoulder area.
- Radiation pressure of body plies.
- Use an unbonded body ply with the thickened rubber side against the inner liner.

14) Cured tire blisters
1) Excessive air trapped at tire assembly.
2) Poor inner liner to carcass tack.
3) Poor hot cured adhesion between liner and carcass.
1) Perforate carcass plies.
- Improve stitching procedure during tire building.
2) Impose tack (see B.2).
3) Check blisters for contamination and eliminate.
4) Use BIIR rather than CIIR.
Problem Solving Guide

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HALOBUTYL TIRE INNER LINERS

The purpose of this guide is to provide assistance in processing 100% halobutyl inner liners. It has been developed through various factory evaluations and presents the problems that most frequently arise, probable causes, and suggested remedies. The guidelines are general in nature, and causes and remedies may differ due to individual plant conditions and equipment. In situations where a selected remedy may not work or only be partially successful, being aware of some potential causes should help to determine which causal factors may be contributing to the problem. Designed experiments may also help in this process.

The following formulation is a good starting point for development of a 100% bromobutyl inner liner; it exhibits a good balance of processing and performance parameters.

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<tr>
<th>Formulation</th>
<th>Amount</th>
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<tr>
<td>LANXESS BROMOBUTYL</td>
<td>100 (phr)</td>
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<td>N660 black</td>
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<tr>
<td>SUNPAR® 2280°</td>
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<td>PENTALYN® A**</td>
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<td>MBTS</td>
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<tr>
<td>Sulfur</td>
<td>0.5</td>
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<tr>
<td>Zinc oxide</td>
<td>3</td>
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Page 1 of 2. This document contains important information and must be read in its entirety.

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