DEVULCANIZATION OF WHOLE TIRE RUBBER

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AIM

Development of efficient & environmentally sound devulcanization processes for truck as well as passenger car tire granulate

Efficient : devulcanizate needs to be easy blendable with a virgin compound & to be used in higher quantities than the current recycled rubber products

Environmentally-sound : process additives should be as environmentally safe as possible

[1]

WHY DEVULCANIZATION ?

Lansink's Ladder

[2]

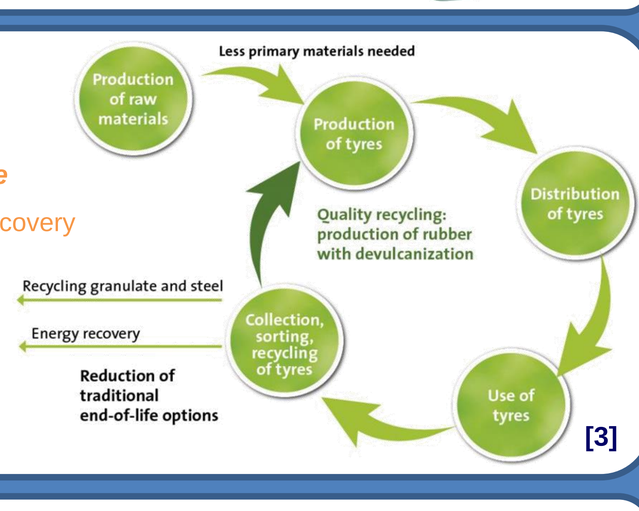
Vulcanization - an energy intensive process to shape rubber products giving durability

Did you know: ***Annually 10 million used tires are discarded in Netherlands alone***

Mostly these tires are recycled in a cradle-to-cradle approach or incinerated for energy recovery

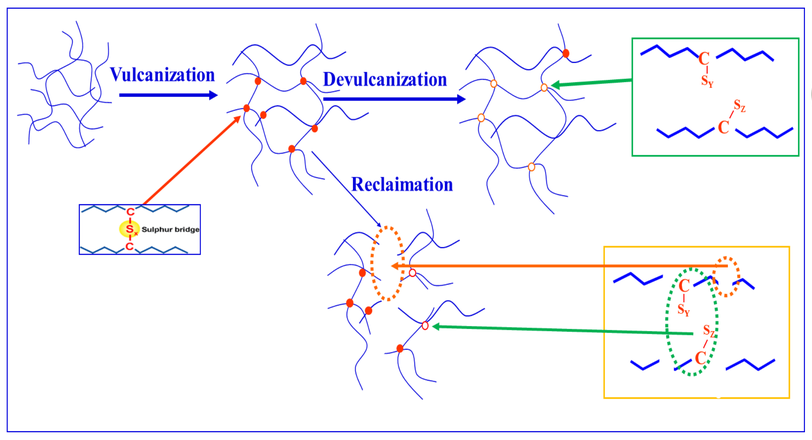
Pros of De-Vulcanization:

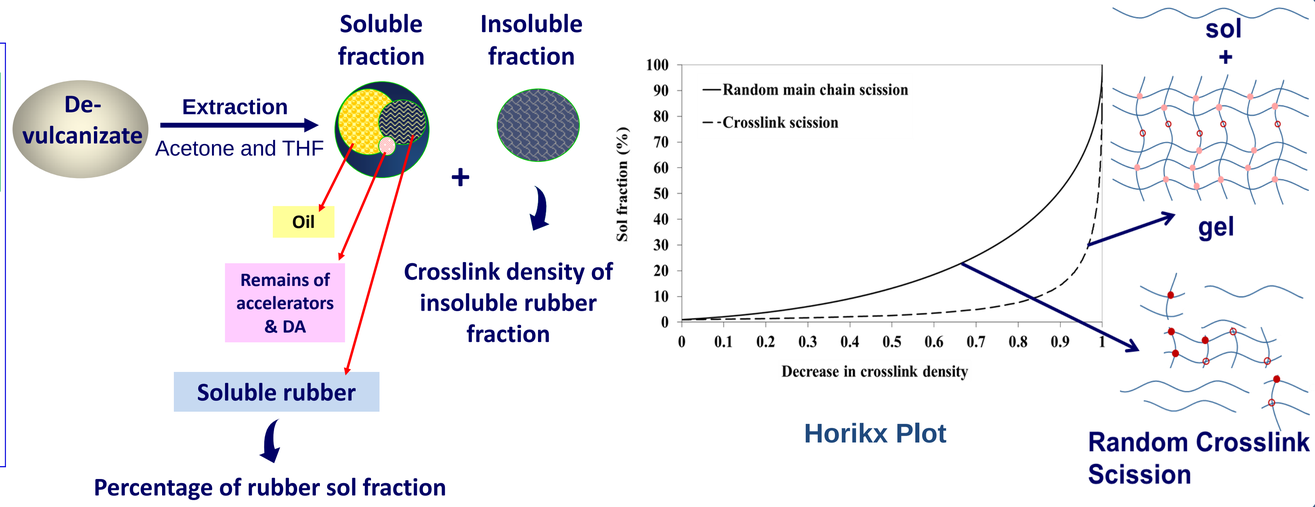
- Reduction of CO_2 emission
- Re-use of tires in tires
- Cost reduction
- Reduce the need for primary raw materials



[3]

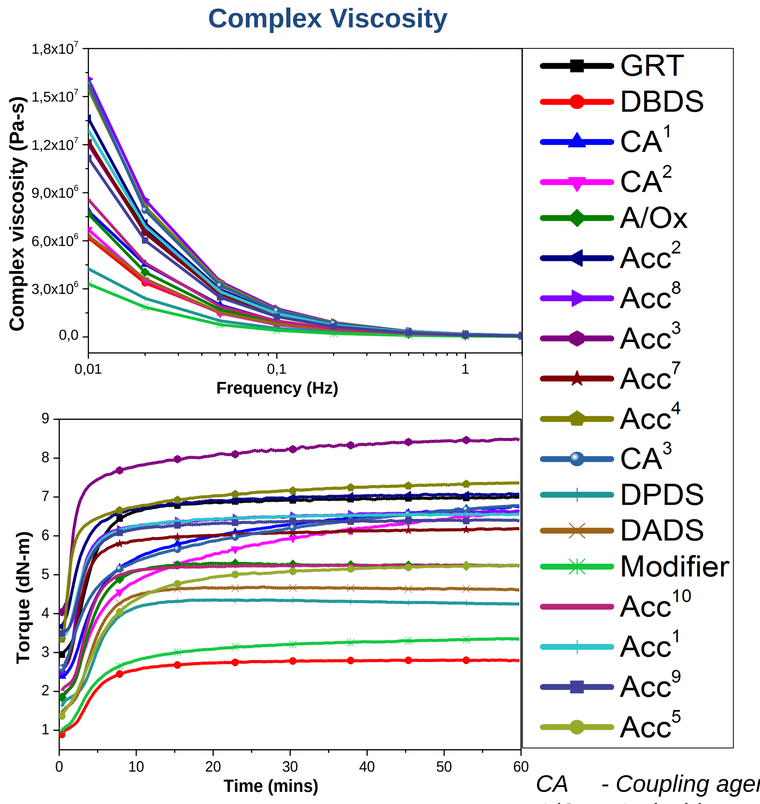
DEVULCANIZATION VS RECLAIMING





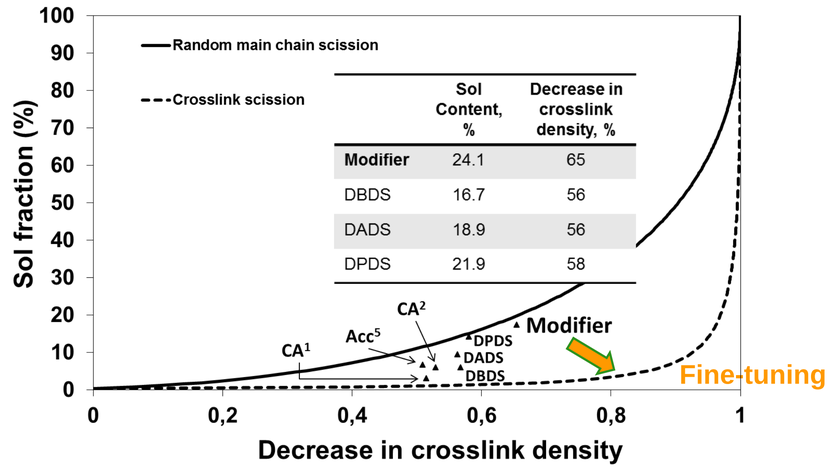
CHOICE OF DEVULCANIZATION AIDS

Complex Viscosity

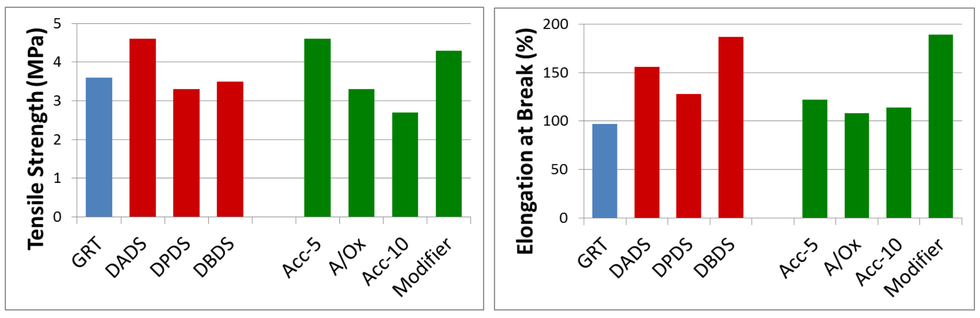


Rheo Curve

CA - Coupling agent
A/Ox - Antioxidant
Acc - Accelerator



	Sol Content, %	Decrease in crosslink density, %
Modifier	24.1	65
DBDS	16.7	56
DADS	18.9	56
DPDS	21.9	58



Smell-Panel results

CA^1
CA^2
CA^3
A/Ox^1
Acc^1
Acc^2
DBDS
Acc^3
Acc^4
DPDS
Acc^5
Acc^7
DADS
Acc^8
Acc^9
Acc^{10}
Modifier

** 4 devulcanizates were choosen on the basis of Horikx plot, complex viscosity, curing behaviour & sheetability*

Due to confidential reasons, the devulcanization aids can't be described more in detail.

CONCLUSIONS

Modifier is the best choice as Devulcanization-Aid

- High crosslink density decrease & sol content comparable to DPDS devulcanizate
- Low complex viscosity
- Better mechanical properties than DPDS devulcanizate
- Low smell level

References:

[1] http://fremonttownship.com/news-release/lake-county-tire-recycling-event/, (12-03-2015)

[2] http://www.recycling.nl/blog/35-jaar-ladder-van-lansink/ (12-03-2015).

[3] http://www.recybem.nl/en/raw-materials-future, (12-03-2015)

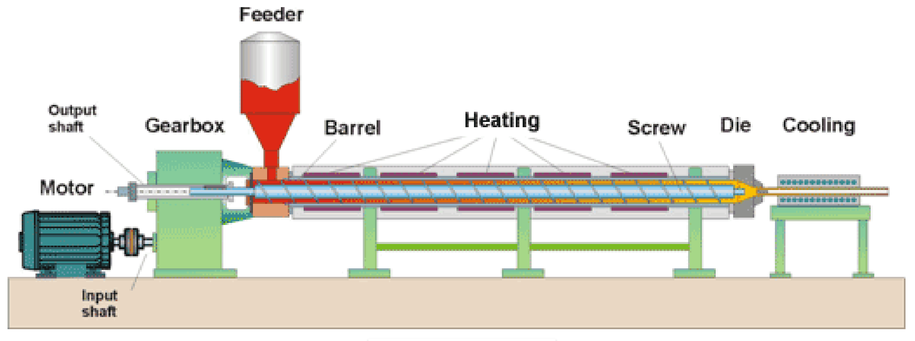
[4] http://www.theadvancedteam.com/laser_extruder.php, (12-03-2015).

NEXT STEP

Batch experiments

- Temperature
- Time

Continuous process



Extrusion Process

[4]

- Screw configuration
- Screw speed
- Temperature
- Residence time
- Throughput