



UCC

Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland

**Composite
Recycling Ltd**

Whole tire pyrolysis (recycling) with molten metals / salts

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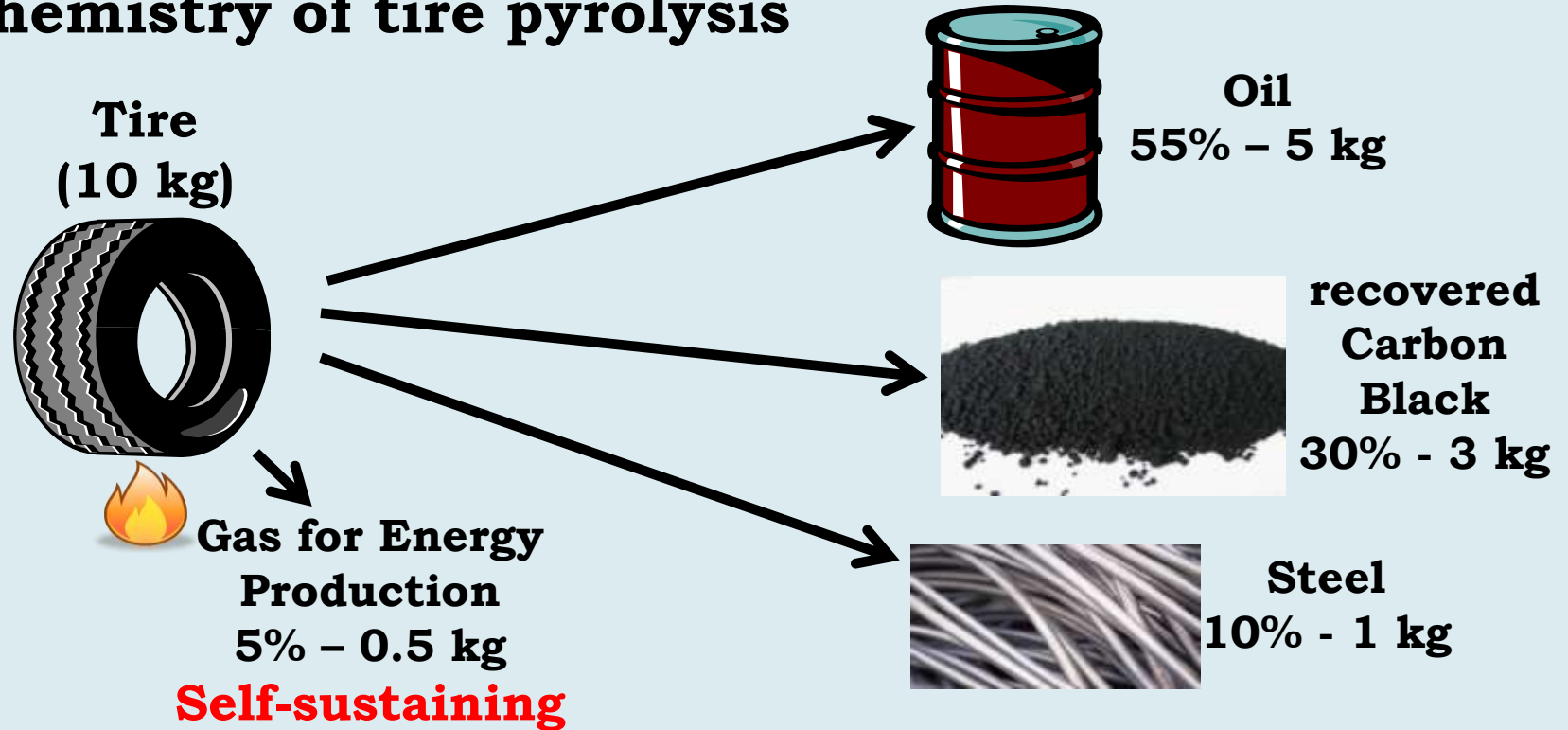
Waste Tire Pyrolysis

Contents

1. Challenge
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3. Experiments – the evidence
4. Towards a full scale plant

Challenge

Chemistry of tire pyrolysis



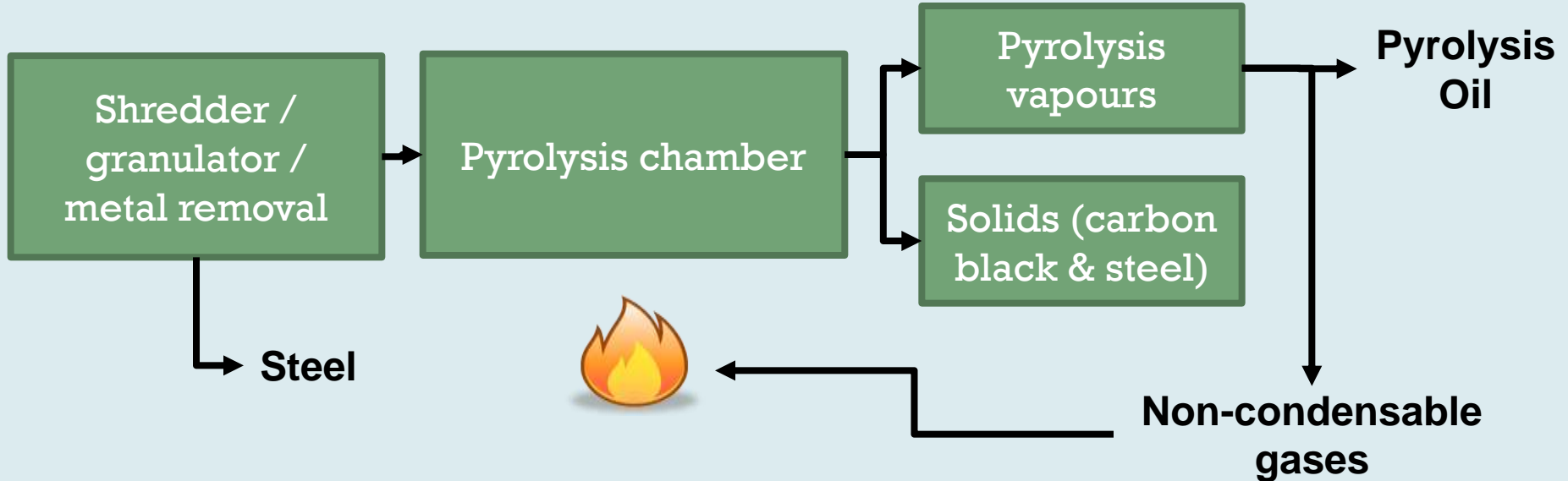
Challenge

Eight requirements

1. Whole tires – no shredding, no granulating
2. Simple (Low tech, low pressure, existing technology)
3. Scalable (1,000 – 100,000 t/y)
4. No pre-drying
5. Continuous
6. Separate recovered carbon black / steel
7. Direct heat transfer - rubber is an insulator
8. Safe

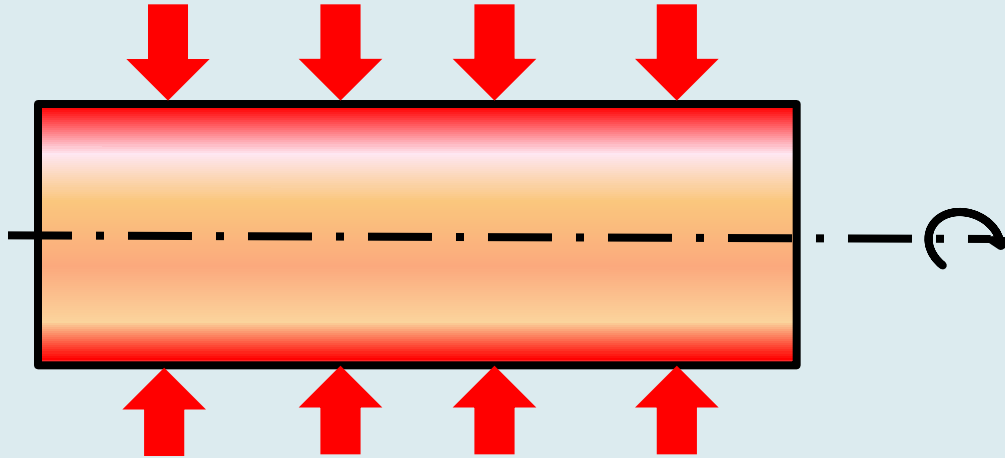
Challenge

Conventional tire pyrolysis process



Challenge

Indirect heat transfer



**Heat slowly propagates from the surface to the center.
Residence times 2-4 h at 450-500°C**

Challenge

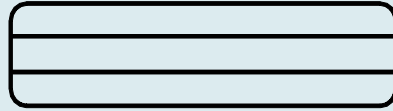
Direct heat transfer – fastest heat transfer



Residence time ~30 minutes at 470°C

Composite Recycling Ltd Process

Process Concept

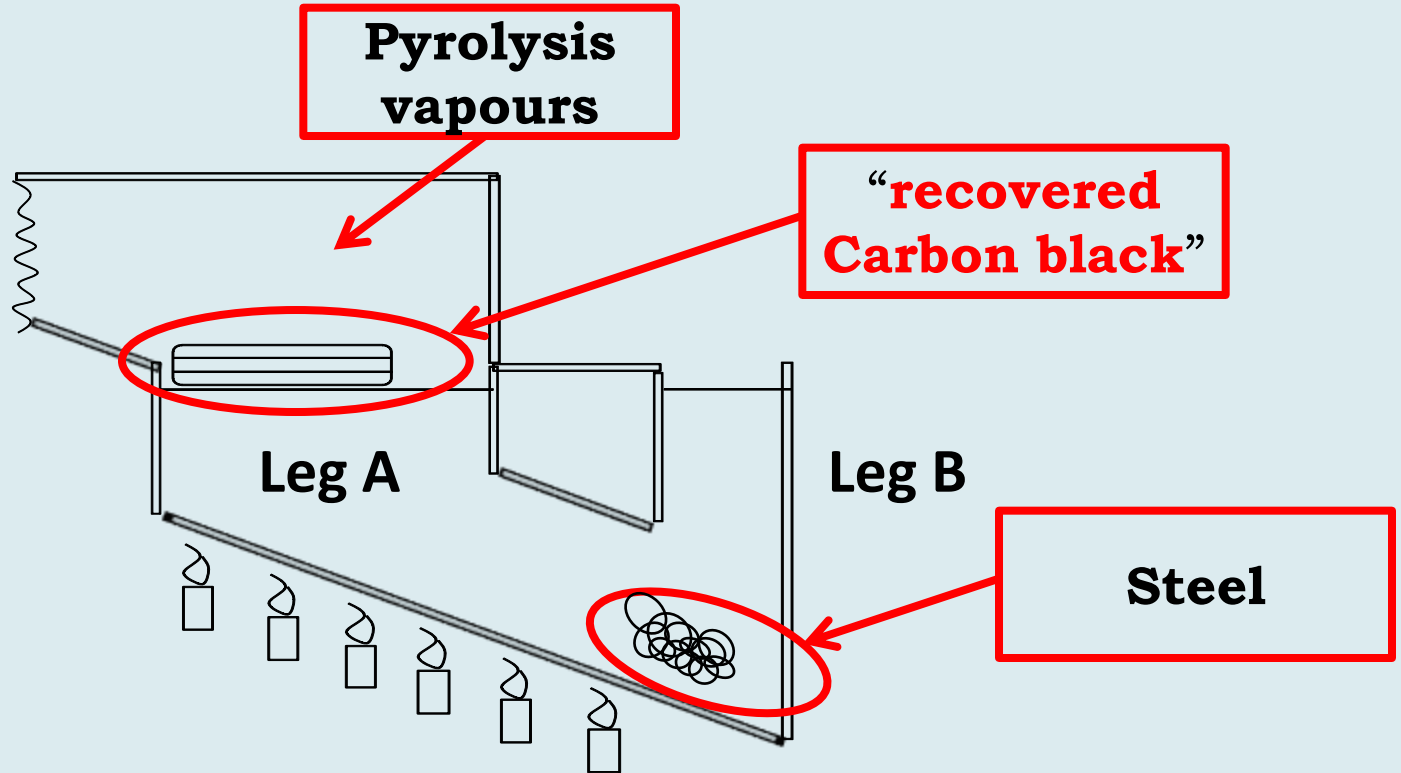


Meets the eight requirements:

1. Whole tires – no shredding, no granulating
2. Simple (Low tech, low pressure, existing technology)
3. Scalable (1,000 – 100,000 t/y)
4. No pre-drying
5. Continuous
6. Separate carbon black / steel
7. Direct heat transfer - rubber is an insulator
8. Safe

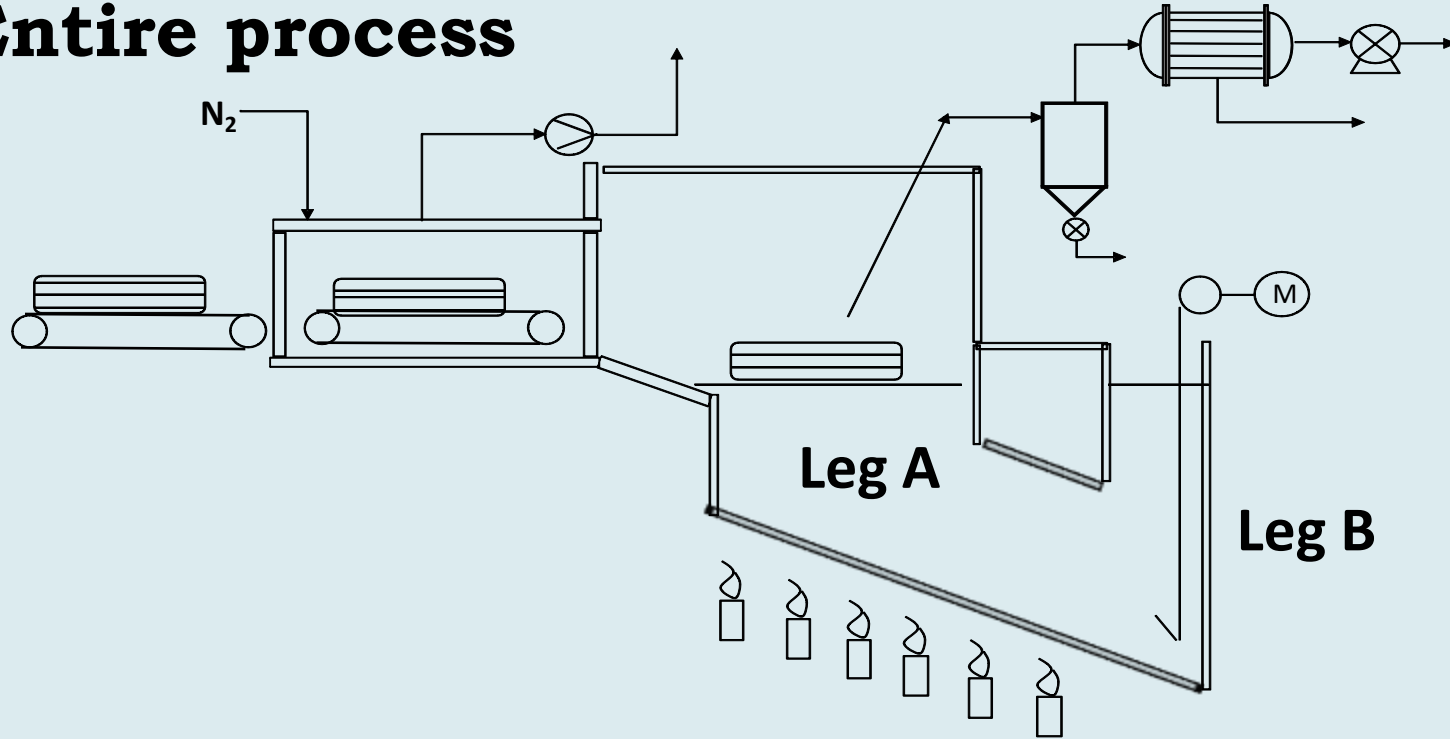
Composite Recycling Ltd Process

Reactor



Composite Recycling Ltd Process

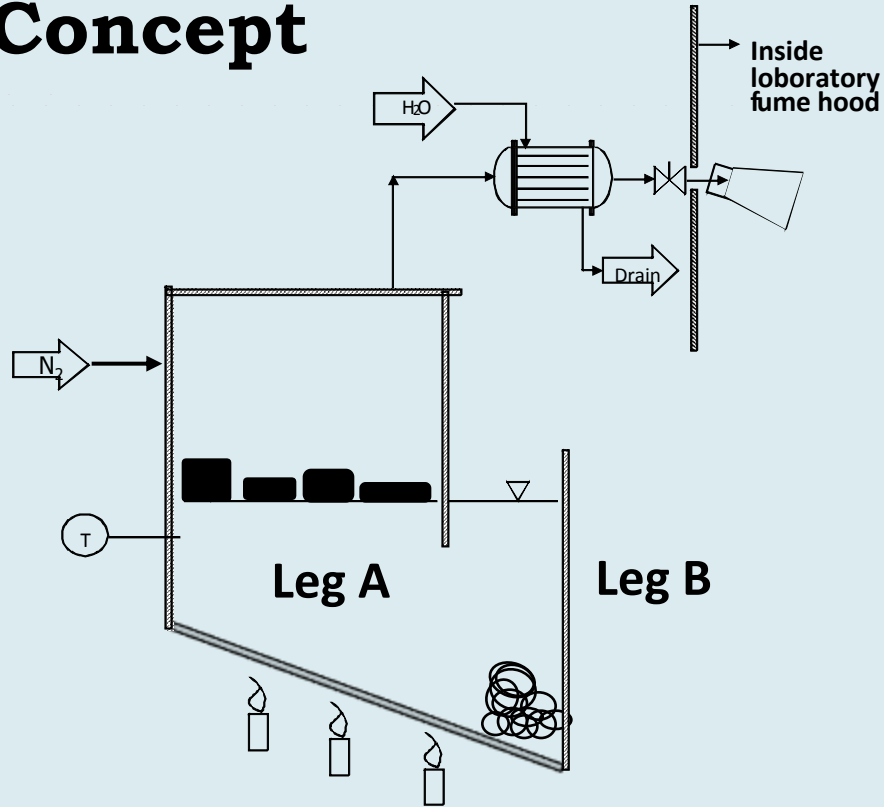
Entire process



Experiments – the evidence

Laboratory

Concept



Experiments – the evidence

Laboratory

Results – decomposed rubber (recovered Carbon Black)



— bar = 10 mm

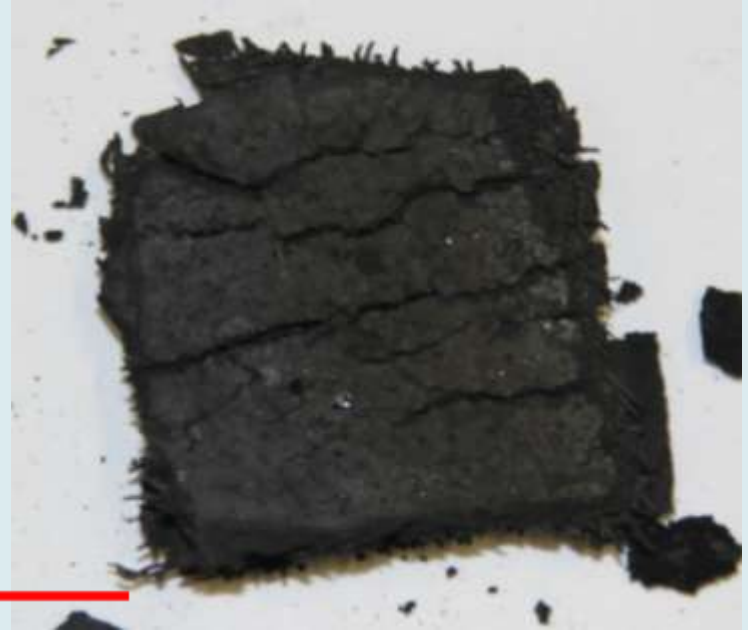
Experiments – the evidence

Laboratory

Results – recovered Carbon Black (rCB)



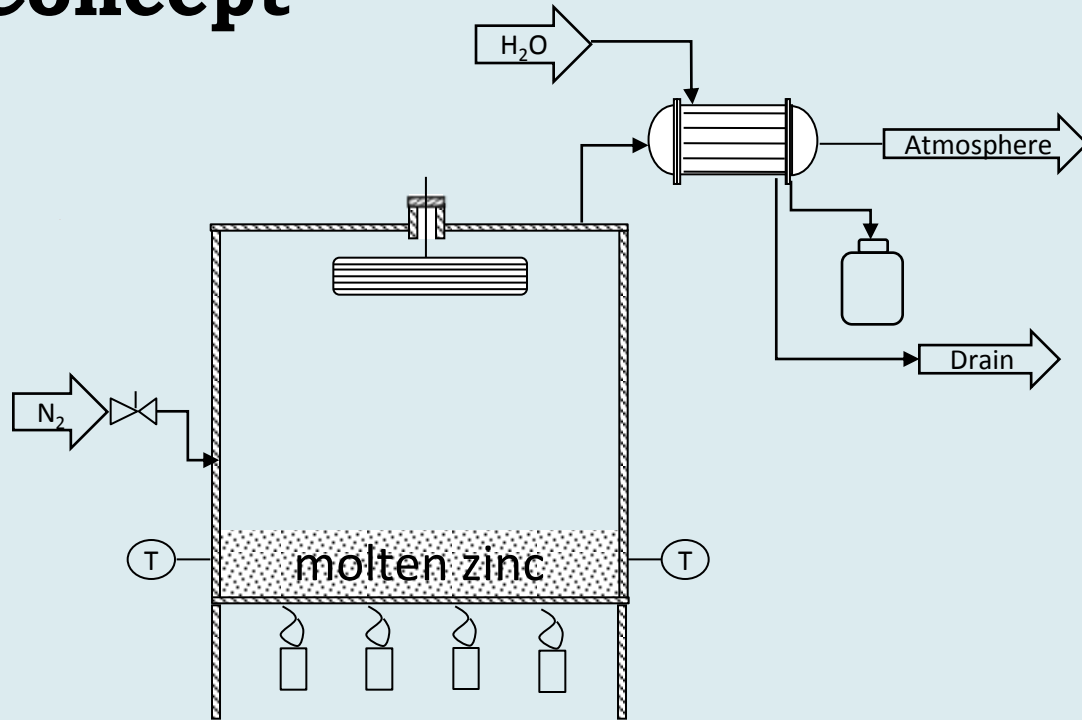
**rCB from leg A
containing wires
(red arrows)
(bar = 10 mm)**



Experiments – the evidence

One Tire Experiment

Concept



Experiments – the evidence

One Tire Experiment

Pyrolysis oil collected



15 min



20 min

Experiments – the evidence

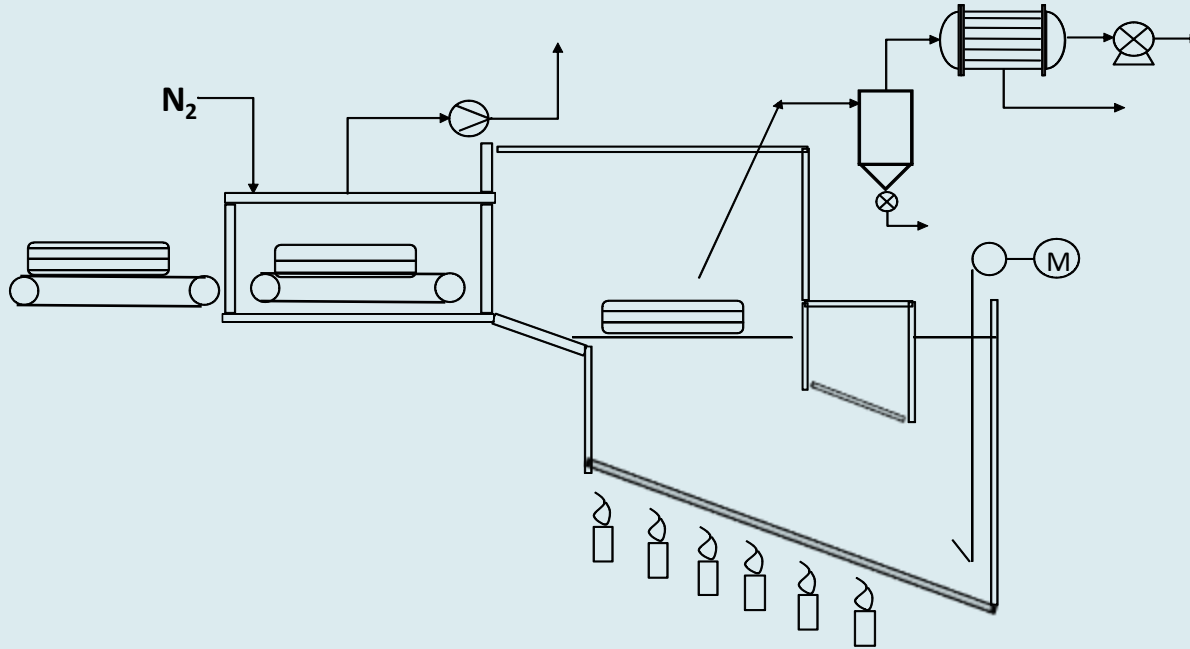
One Tire Experiment

Tire (rCB) floating on molten zinc (470°C)



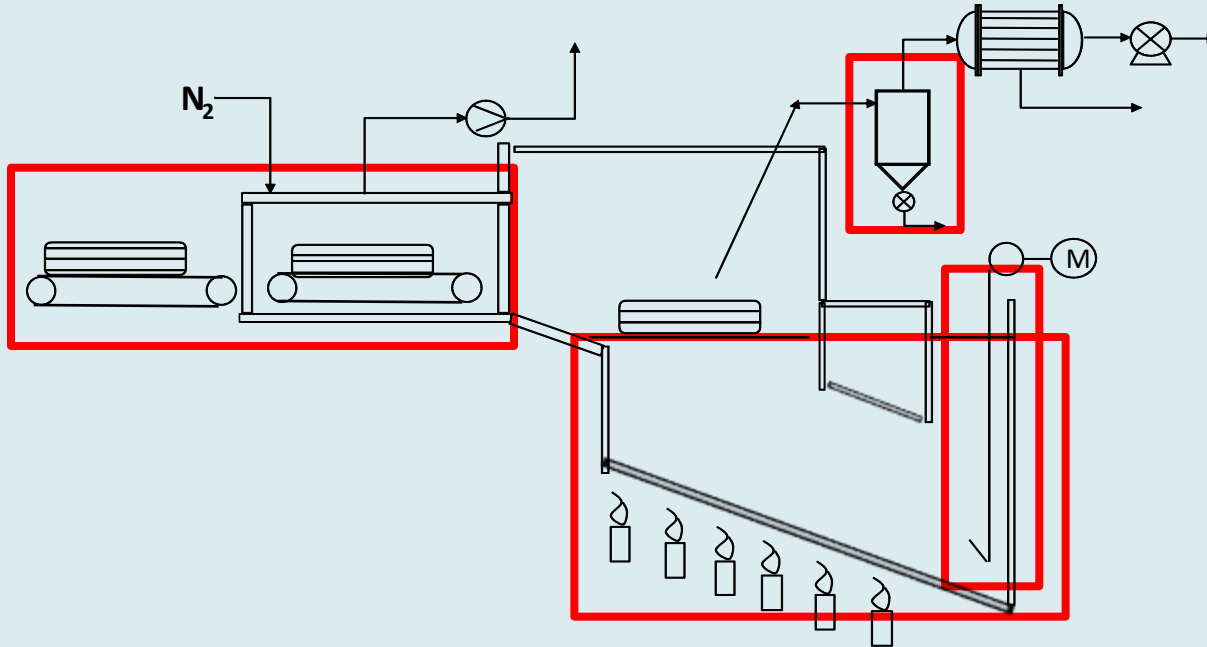
Experiments – the evidence

Proof of concept achieved



Towards a Full Scale Plant

Use proven, existing technologies



Towards a Full Scale Plant

Scrap tire feeding system



Towards a Full Scale Plant

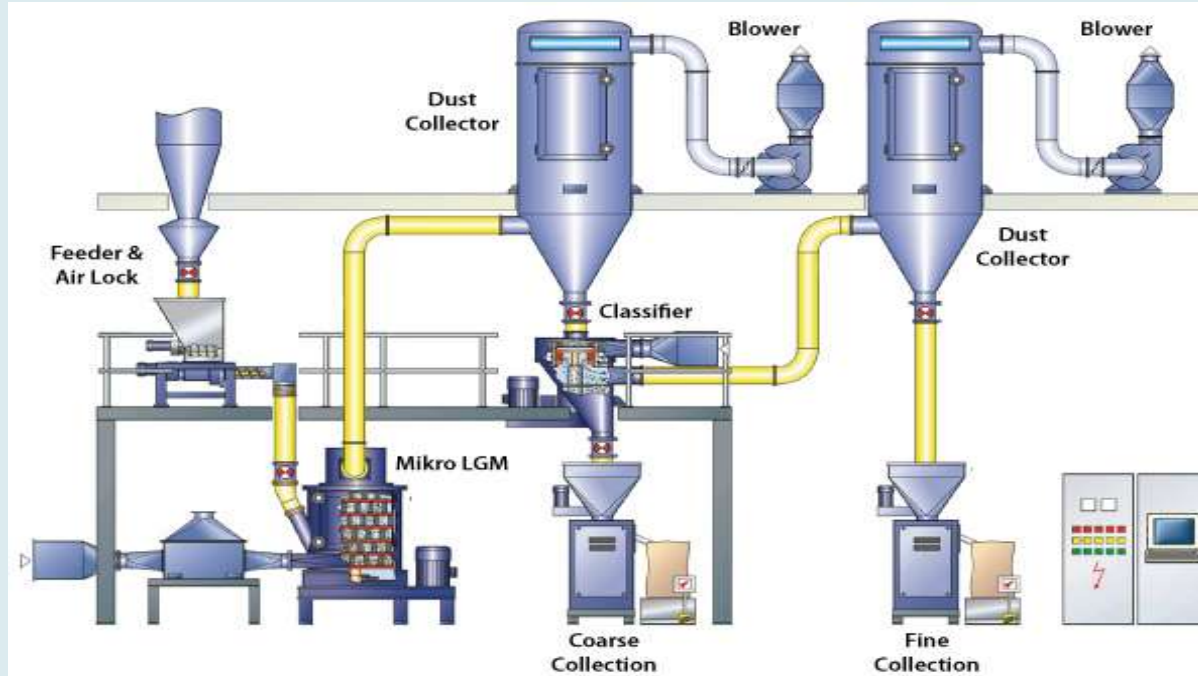
Pyrolysis chamber – hot dip galvanizing



MOC = 316 SS

Towards a Full Scale Plant

Carbon black recovery – carbon black manufacture



Towards a Full Scale Plant

Steel removal – hot dip galvanizing



Steel is galvanized

Towards a Full Scale Plant

Zinc recovery



Composite Recycling Ltd Process

Advantages

- Whole tires (also shredded tires)
- Direct heat contact → smaller plant
- Carbon black / steel separation & pyrolysis in one unit operation (compact process)
- No scale-up issues
- Tyres may be wet
- Carbon black fraction (high quality) may be achievable
- Simple reactor (no moving parts)

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The next steps

1. Investment
2. Demonstration plant – proof process

