Tyre Degradation

→ Grip Generation.

To understand you've to understand how the tyre as a compound generates grip.

- Rubber being a viscoelastic material, stretches and returns to actual shape after a period of time - during this energy is lost in form of heat - Hysteresis.

This is why tyre temperature increases with lap.

↳ The viscoelastic nature enable tyres to generate grip in two ways.

1. Indentation:
   - Roughness of the surface excites the rubber, as it takes time to return, leads to asymmetrical deformation and friction force.

2. Adhesion:
   - Rubber bonds with surface, stretching the molecules, but viscosity ~~resists~~ resists creating frictional force.

→ Working Range.

↳ For grip to be generated at maximum via adhesion & indentation, rubber must be soft and flexible.

↳ For the rubber to be soft, it must operate in optimum temperature. - working Range.

↳ Too cold - compound stiff, Too hot - modulus decreases, both cases low grip.

↳ Five slick tyre compounds (C1, C2, C3, C4, C5), web and intermediates

C1 - Hardest, C5 - Softest

↳ Soft compounds - lower working range - more flexible - rubber stretches fast and generates heat fast - grip ~~more~~ generated early. - suitable for less heat circuit or fewer laps.

If combined with high temperature working range, overheats and degrades the rubber faster.

↳ Hard compounds. - higher working range - stiffer rubber - generates minimal heat - rely on high speed corners and rough surface to excite the rubber - high temperature circuit.

↳ Soft compounds - easy to warm - suited for ~~cold~~ cool conditions, smooth tracks and less high speed corners.

Hard compounds - need to be warmed - suited for high surface temperature and rough tracks - less overheating and damages to the surface of tyre.

→ What is tyre degradation?

↳ With no enough grip, tyres slides across the surface - overheating and causes 2 types of degradation:

1. Thermal
2. Wear.

↳ Thermal degradation:

- Rubber becomes too hot that the materials change it's properties. the compound becomes harder.
- It cannot stick to the surface as much - leading to less grip and smaller contact patch.

↳ Wear degradation:

- Rubber slides across the track causing pieces of rubber to wear.
- Mechanisms of wear degradation in Formula 1:

1. Abrasion:

↳ Uniform pattern of ridges and spots as the tyre slides across.

↳ Called "Normal Wear."

2. Graining:

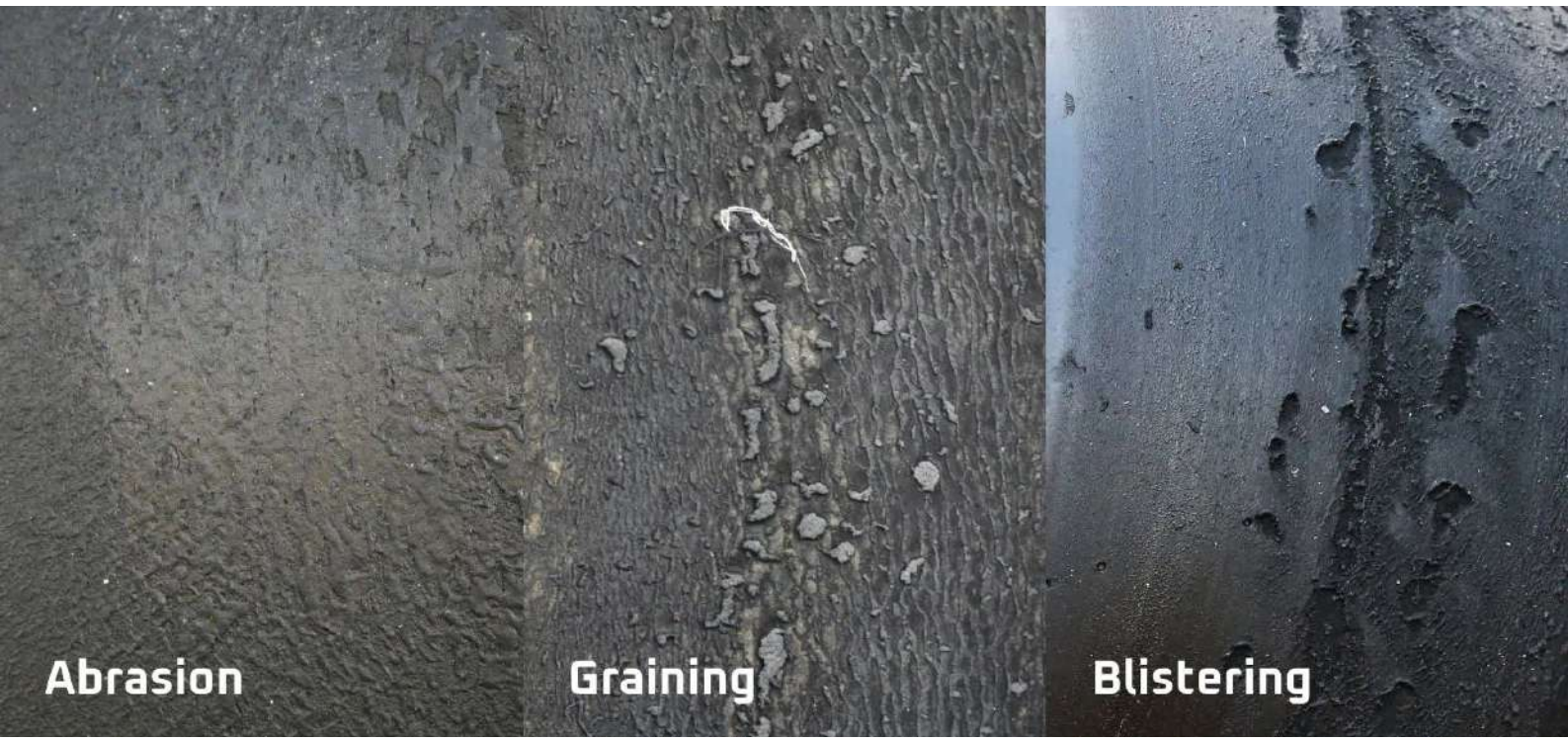
↳ Extreme Abrasion

↳ Rubber shears away and rolls into small grains.

↳ Pattern of wavy ridges on surface.

3. Blistering:

↳ Rubber overheats and essentially boils and producing bubbles that explode removing chunks of rubber from surface.


Abrasion
Graining
Blistering