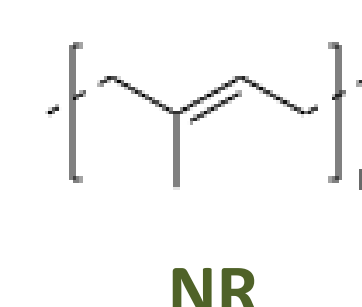
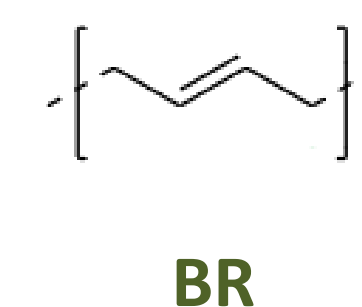
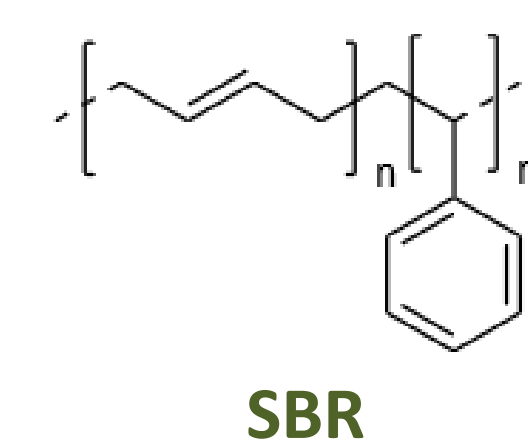


## INTRODUCTION

- Vehicle usage generates **Tyre and Road Wear Particles (TRWP)**, polymer fragments of tyre and asphalt.
- The small particle size makes **TRWP** susceptible to atmospheric and runoff transport, thus affecting large areas, in all environmental compartments, specially in urban areas.
- **TRWP** demonstrated detrimental effects in aquatic species, due to the introduction of some endocrine disrupting constituents in their formulation.
- Nowadays, there is scarce information about the occurrence and effects of **TRWP**. There is also a lack of established technique for their analysis and monitoring.

Component	Tyre's Typical composition
Base materials (40-60 %)	Polyisoprene or 'natural rubber' (NR); synthetic-rubber (BR), and styrene-butadiene rubber (SBR)
Reinforcing agent (Filler) (20-35 %)	Carbon black, silica, silanes
Process oils (15-12 %)	Oils and resins
Textile and metal net (5-10 %)	Polymers and steel mesh
Vulcanization agent (1-2 %)	ZnO, Se, S, Te, thiazoles, organic peroxides, nitrocompounds
Additives (5-10 %)	Preservatives, anti-oxidants, plasticizers, processing aids



## EXPERIMENTAL

**OBJECTIVE:** To study several forms of **infrared reflectance measurements** in the medium region in order to ascertain the most suitable one for monitoring purposes. Macro attenuated total reflectance (ATR), micro reflectance spectrometry and micro imaging with a quantum cascade laser-based IR system (LDIR) were evaluated to characterize **tyres, tyre particles (TP)** and **TRWP** samples.

### Tyre samples



- S1: Feu-Vert Efficiency Plus
- S2: Firestone transforce AT2
- S3: Michelin Latitude Sport 3
- S4: Bridgestone Turanza T005
- S5: Pirelli Cinturato P7
- S6: Continental ContiPremiumContact 5



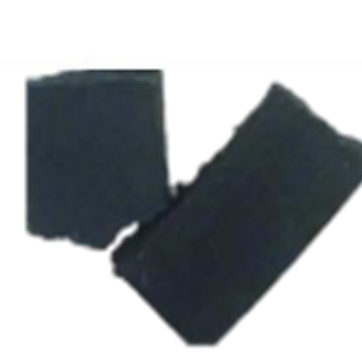
Filing

< 1mm

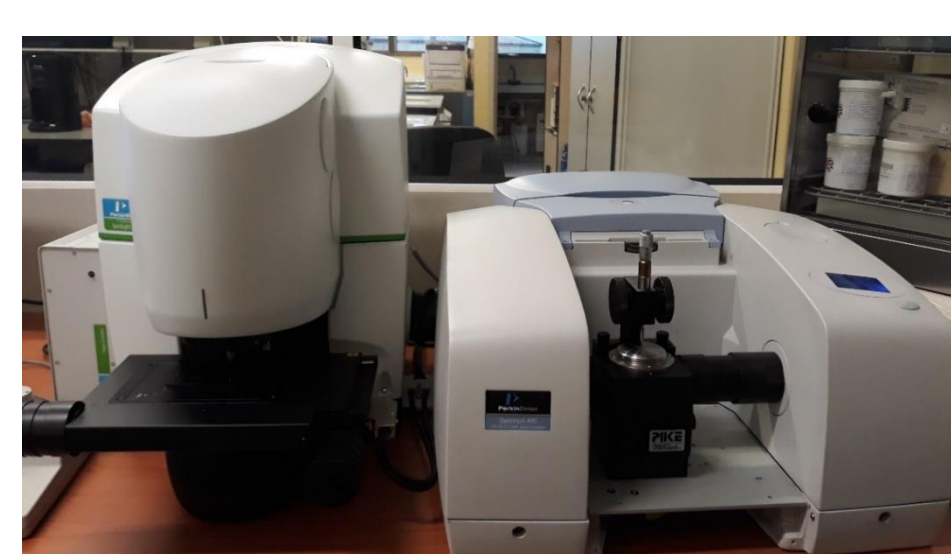


Cutting

0.5-1.0 cm

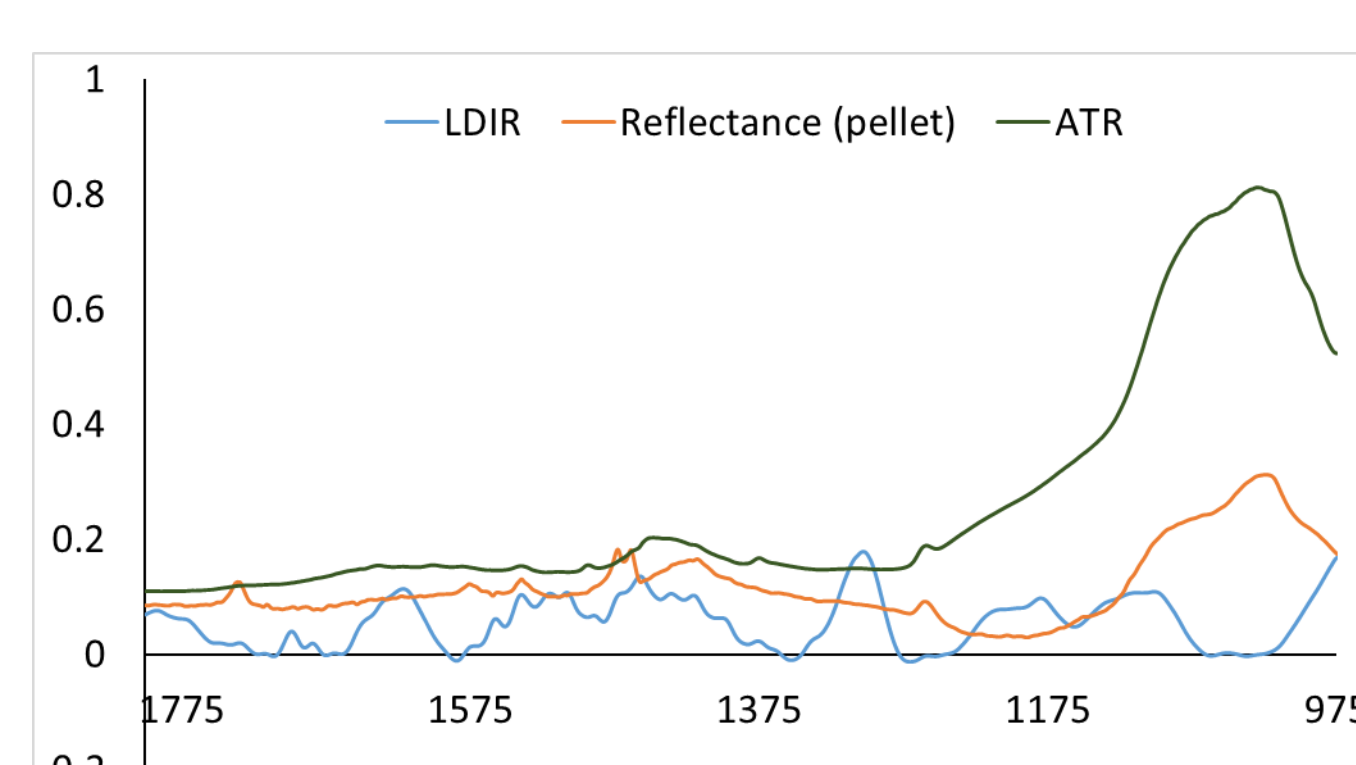
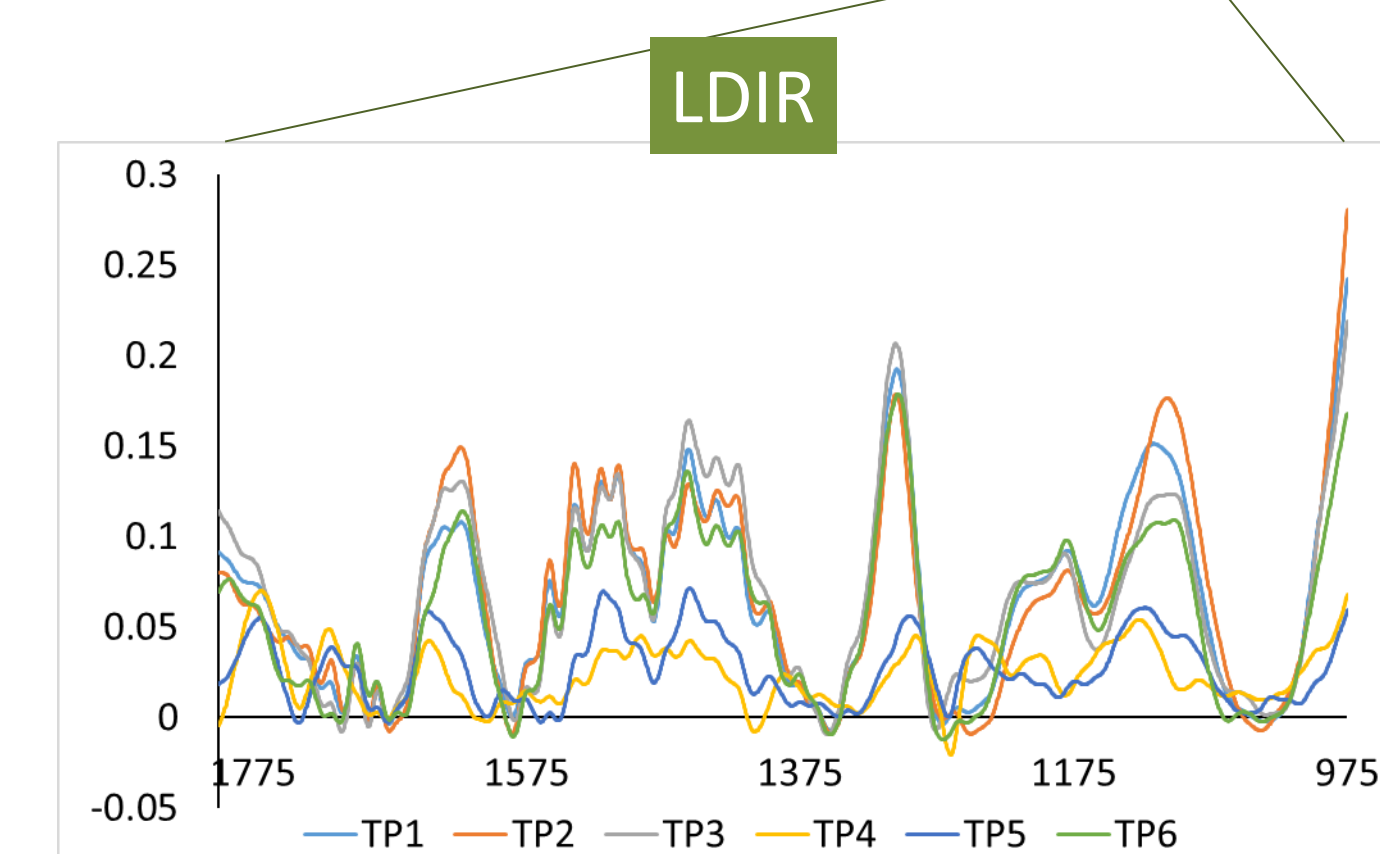
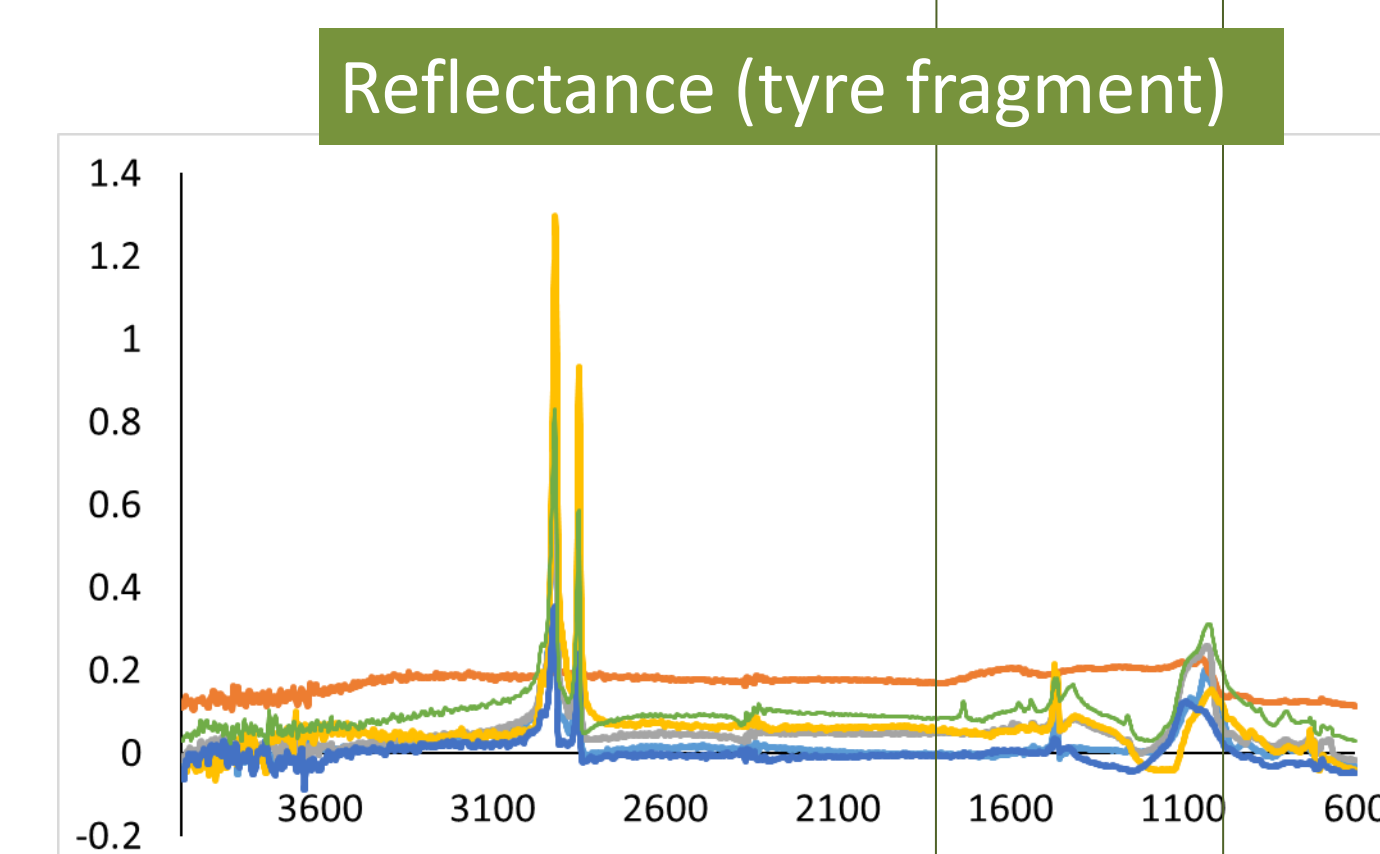
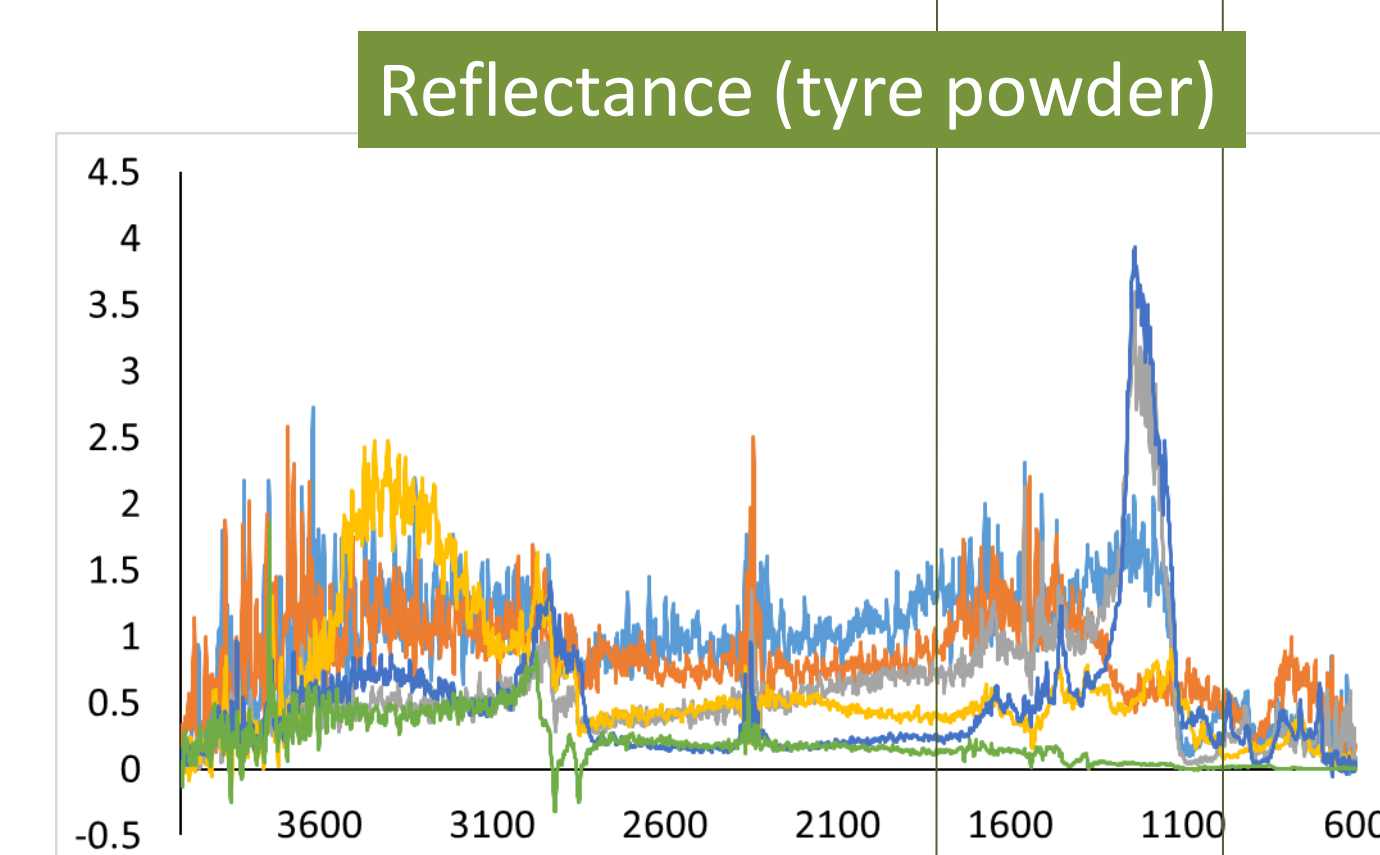
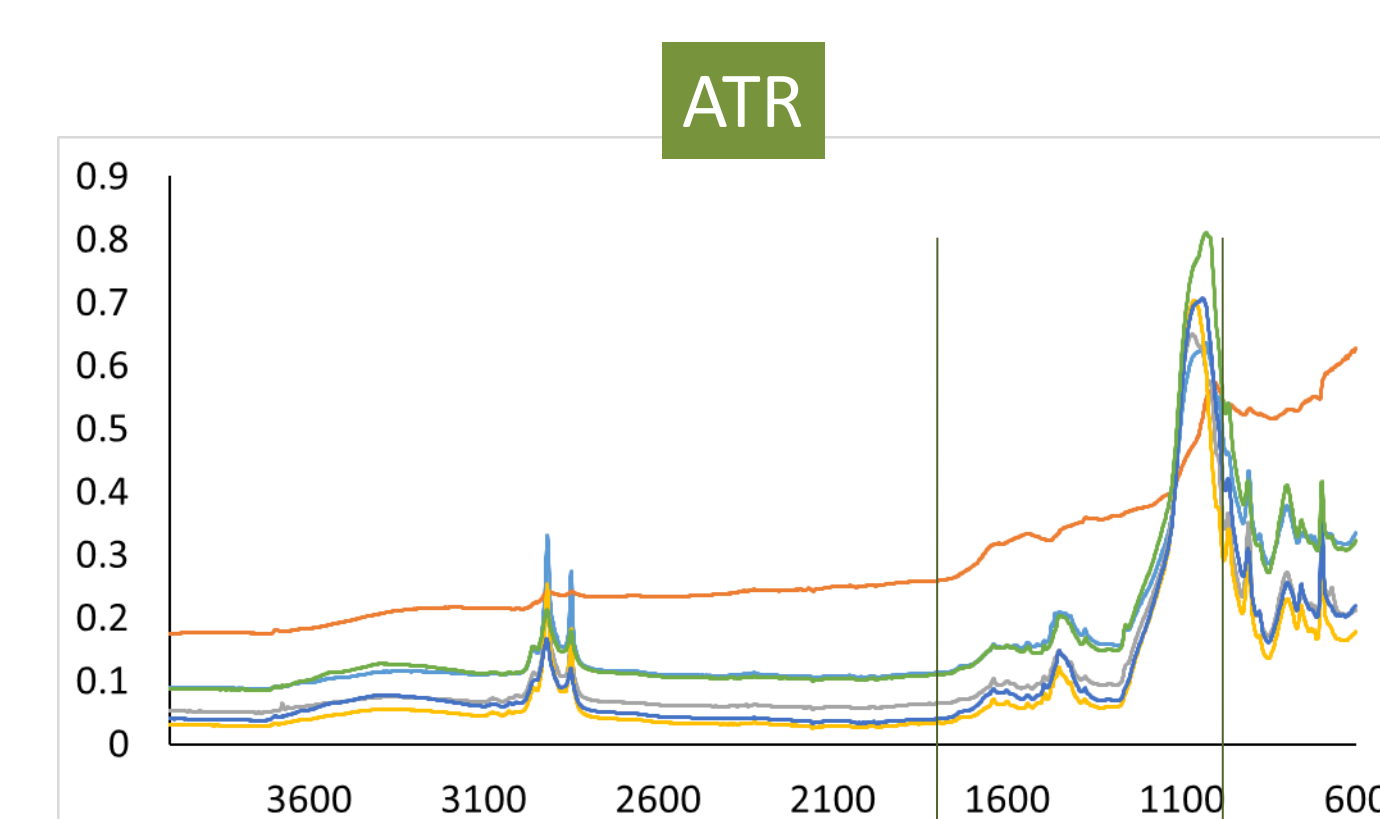


Agilent 8700 LDIR



Perkin Elmer Spotlight 200i

	8700 LDIR	Spotlight 200i, micro reflectance	Spotlight 200i, macro reflectance
Source	Quantum cascade laser	NiCr filament	NiCr filament
Detector	MCT (electronic Peltier cooling)	MCT (liquid N <sub>2</sub> cooling)	TGS (Deuterated Triglycine sulfate)
Mode	Micro transfectance	Micro reflectance	ATR
Resolution	8 cm <sup>-1</sup>	4 cm <sup>-1</sup>	4 cm <sup>-1</sup>
Spectral range	1800-975 cm <sup>-1</sup>	4000-600 cm <sup>-1</sup>	4000-600 cm <sup>-1</sup>
Processing	None	Kubelka-Munk or Kramers-Kronig	ATR correction



Example: Superposition of spectra of sample S6 obtained by 3 different techniques (Range: 1800-975 cm<sup>-1</sup>)

## CONCLUSIONS

- ✓ **Reflectance measurements** on the powdered samples offer no reliable information due to the low S/N ratio.
- ✓ More defined spectra can be obtained by using the tyre **fragments**.
- ✓ **Slight differences** were observed between some of the car tyre samples, but mostly with the truck tyre (different compositions).
- ✓ **LDIR** provided a more detailed insight into the fingerprint region of the samples. A clear difference between S4-5 and the other samples was detected, as well as better spectra of the truck tyres.

### Acknowledgements

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