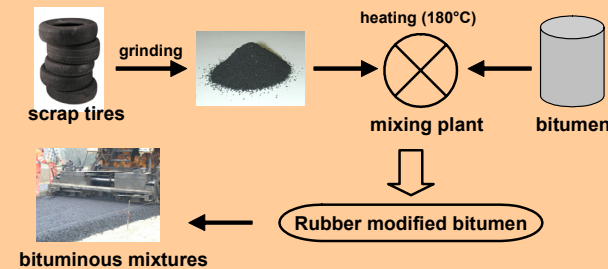


# Rheology of rubber modified bitumen with mechanical behaviour prediction

## SCOPE OF THE RESEARCH

- Experimental determination of the composite rheology
- Modelisation of the composite viscoelastic behaviour
- Investigation on the interactions between components
- Proposal of predictive models for the mechanical behaviour

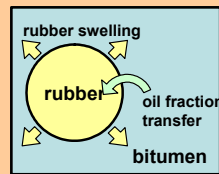
## THE COMPOSITE



## INPUTS OF THE MODEL

### MIXING AND HEATING ⇒

1. Rubber Swelling
2. Bitumen Brittleness/Hardening
3. Composite Viscoelasticity



### 1. VOLUMETRIC CONTENT OF HETEROGENEITIES ( SWELLING )

Measurement of the real swelling of the rubber : separating the phases by a centrifuge at 160°C

Fig 1 : specimens mounted on a high speed mixer inside and oven



### 2. BITUMEN FRACTIONS KINETICS (CAUSE OF BRITTLINESS)

Measurement of the bitumen composition before and after processing

Fig 2 : IATROSCAN device for determining the bitumen generic composition



### 3. COMPLEX SHEAR MODULUS (VISCOELASTIC PROPERTIES)

Measurement of the bitumen shear modulus and phase angle at different temperatures and frequencies

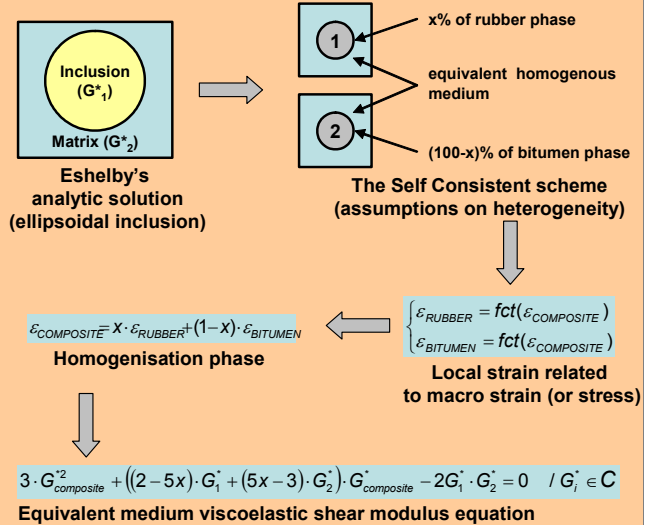
Fig 3 : RHEOMETRICS Dynamic Mechanical Analyser



## WHY USING « Rubber modified bitumen »?

- Improved binder performance
- Sustainable development
- Full-life cost benefits

## THE MODEL



## SOME RESULTS

### MODEL INPUTS :

- Viscoelastic properties of base bitumen and rubber (shear modulus and phase angle)
- Swelling of the rubber (% of the initial rubber volume increase)

### MODEL OUTPUTS :

- Viscoelastic properties of :
  - Composite with and without components interaction
  - Rubber after swelling
- Rubber swelling related to its content, particles size distribution and bitumen chemical composition

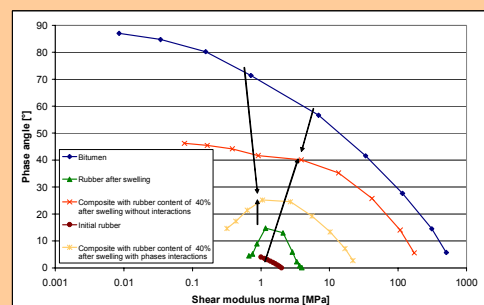


Fig 4 : Base components (measurements) and composite (calculations) viscoelastic properties presented in the Black space

## STILL TO BE DONE

- Comparison of measured and calculated viscoelastic behaviour of the composite
- Proposal of models for estimating swelling and interactions of composite phases