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Formulation of cold recycled asphalt mixtures: a microscopic scale study of bitumen emulsion wetting on virgin aggregates and reclaimed asphalt pavement (RAP)

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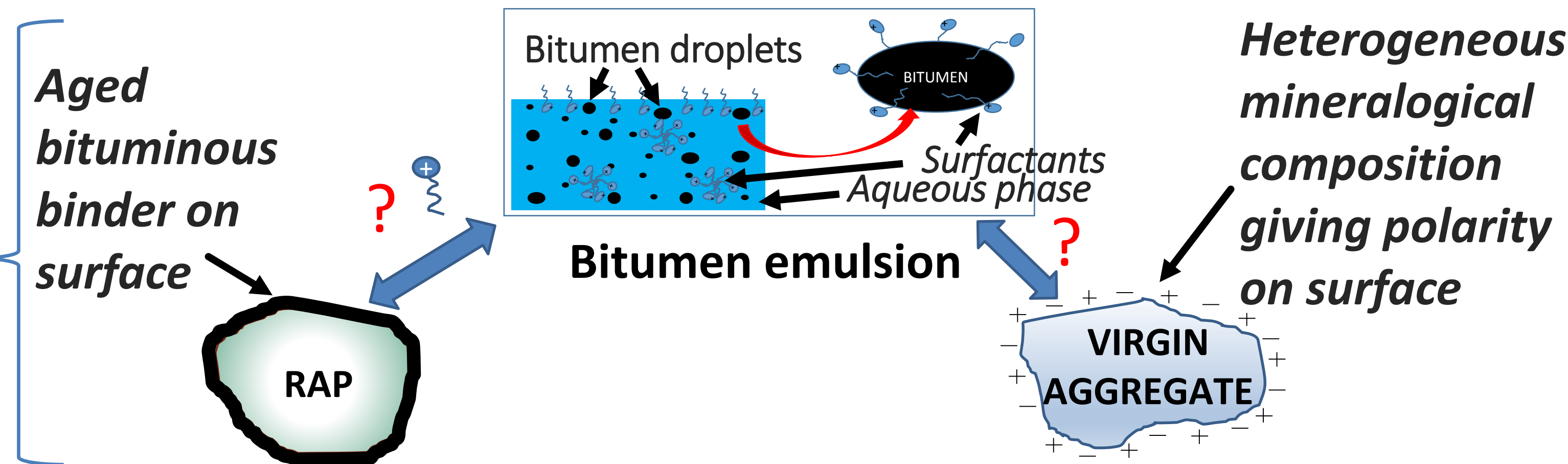
École des Ponts
ParisTech



1 - CONTEXT

The cold mix asphalt technique is considered to be less energy-consuming and more environmentally friendly. Combined with **recycling** of Reclaimed Asphalt Pavement (RAP), it saves non-renewable resources. With a view to guaranteeing constructability, the coupling of both techniques requires the determination of the **formulation** conditions on the basis of knowledge of the interface phenomena between the different constituents of the cold recycled mixture : virgin aggregate and RAP.

Scientific issues concerning cold recycled mixture



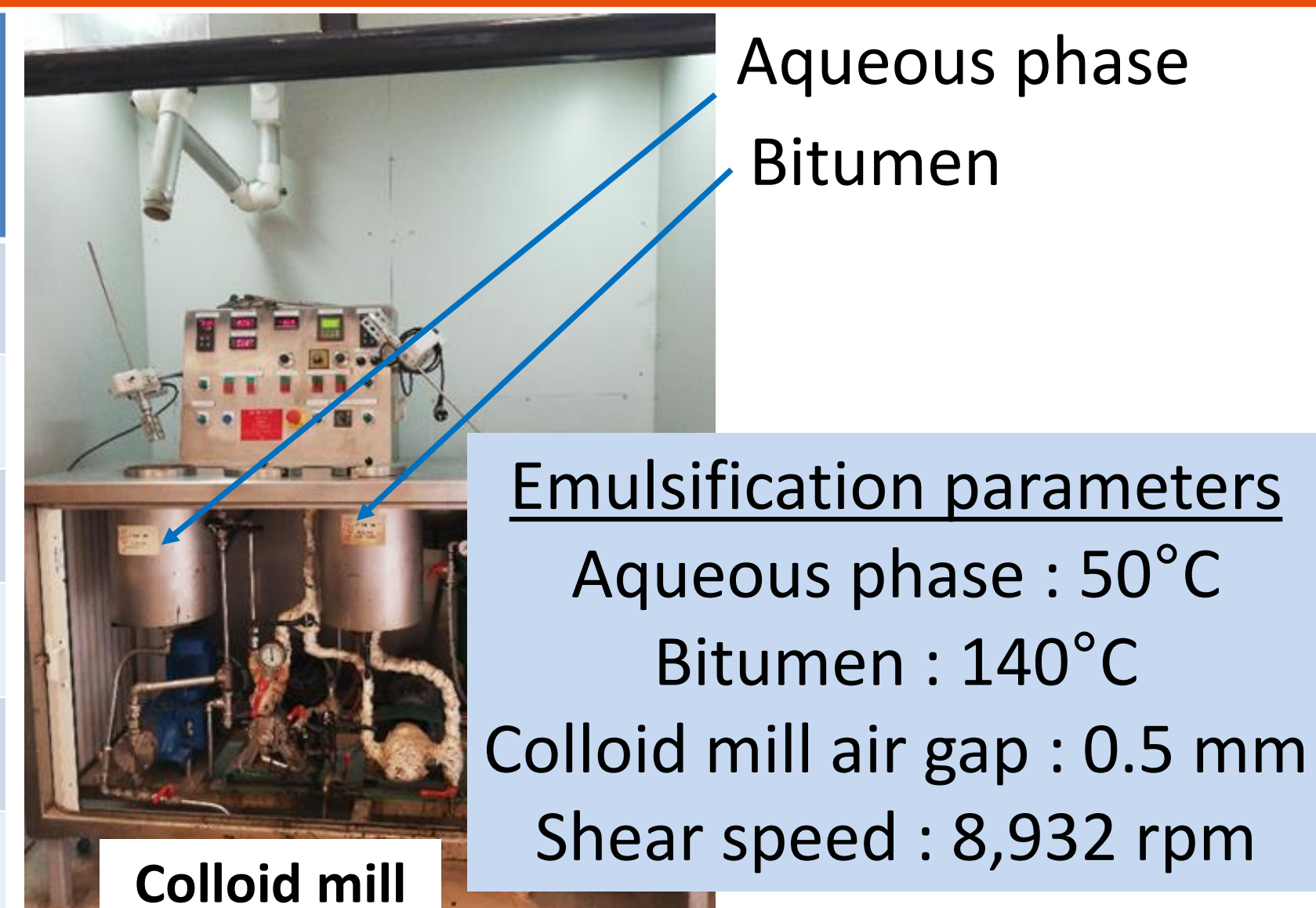
2 - RESEARCH OBJECTIVE

Study of physico-chemical phenomena between bitumen emulsion/virgin aggregate and bitumen emulsion/RAP interfaces to apprehend **wetting** process of emulsion on surfaces of both aggregates types. Determination of cold recycled asphalt mixes **formulation** in order to ensure **durability**.

3 - METHODOLOGY AND APPROACH

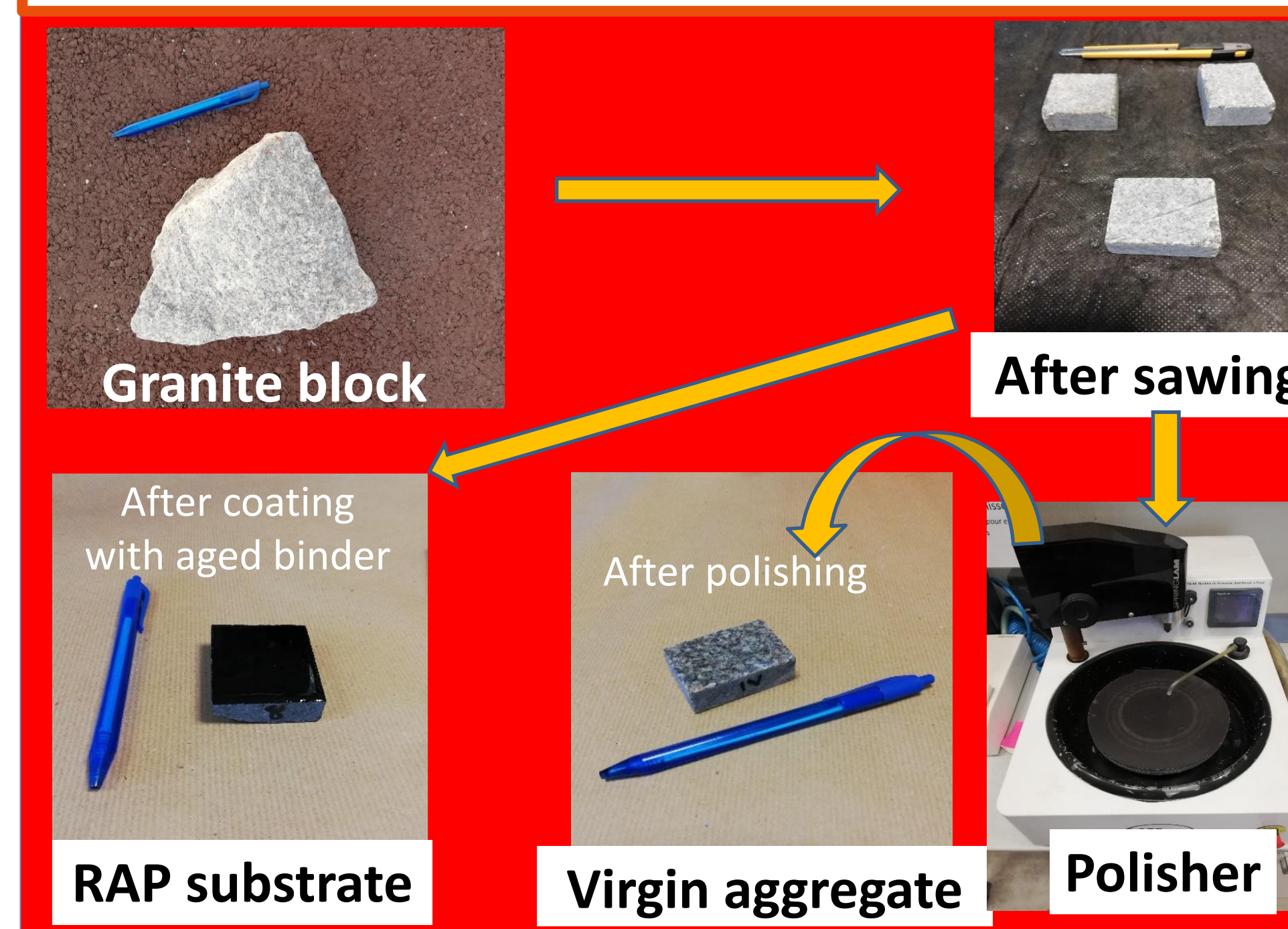
Emulsions formulation by varying surfactant nature and content (70/100 penetration grade bitumen)

Emulsion designation	Emulsifier nature	Emulsifier content	Bitumen content
0.9 % A	A	0.9 %	65 %
1.2 % A	A	1.2 %	65 %
1.5 % A	A	1.5 %	65 %
0.9 % B	B	0.9 %	65 %
1.2 % B	B	1.2 %	65 %
1.5 % B	B	1.5 %	65 %

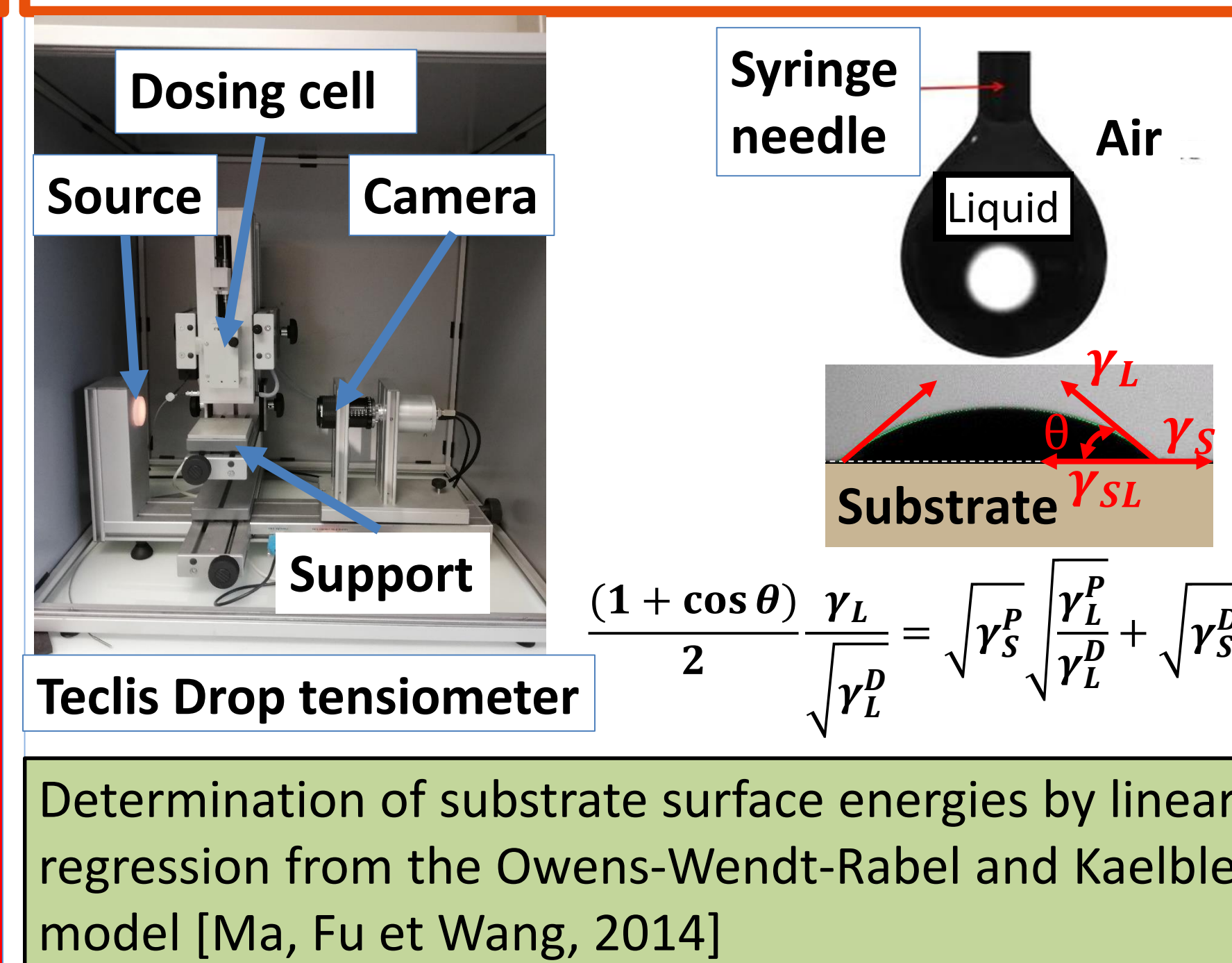


Polyamine surfactants : CMC (A) : 0.6 g/l - CMC (B) : 0.2 g/l

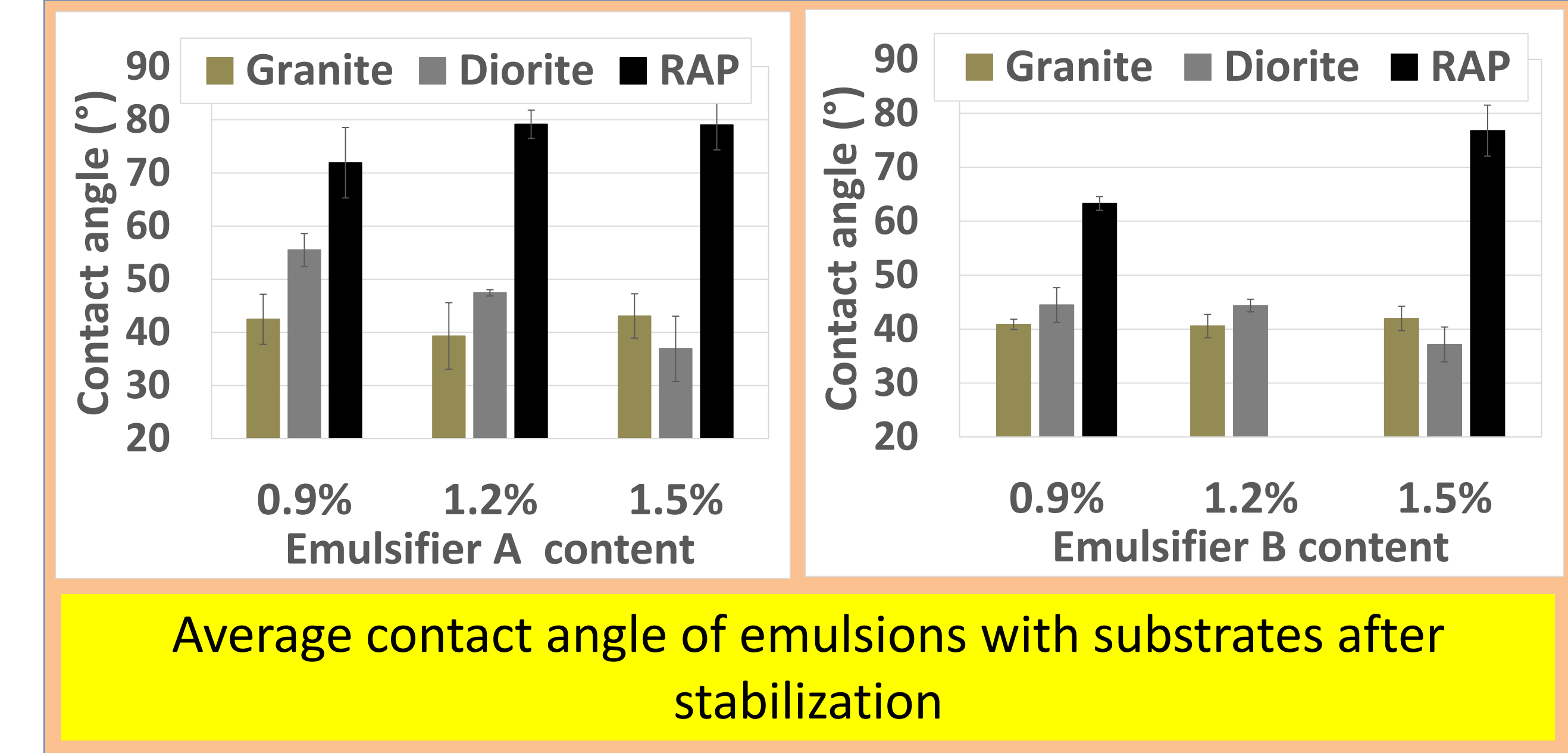
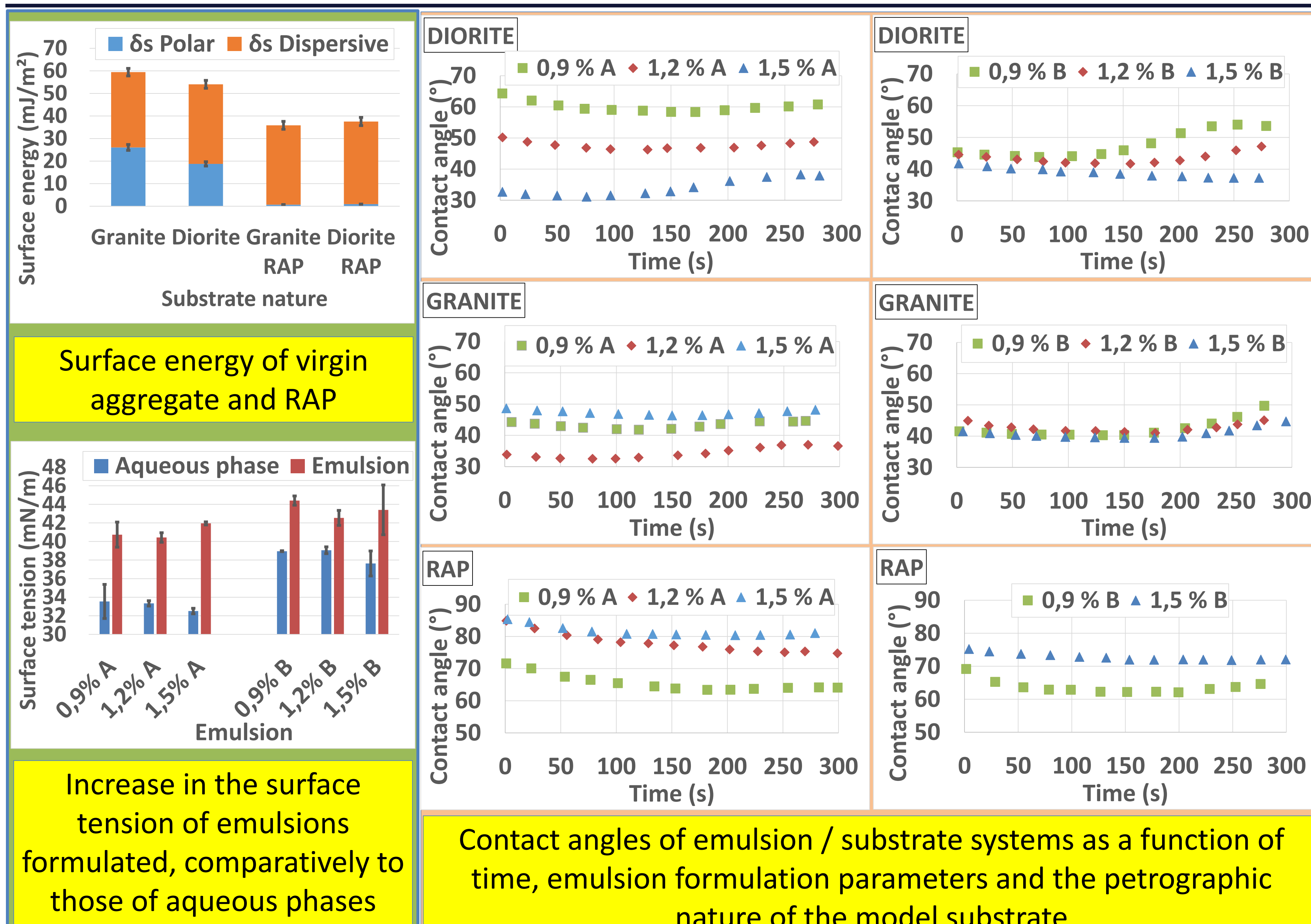
Manufacture of substrate model of virgin aggregate and RAP



Measurement of surface tensions and contact angles with drop tensiometer



4 - RESULTS



5 - CONCLUSIONS

- Switching of a part of free surfactants from the water-air interface to the water-bitumen interface with the addition of bitumen in the aqueous phase.
- Decrease in contact angles with increasing emulsifier content for diorite, because of the high reactivity of this substrate
- Contact angles of emulsions with the RAP higher than those of virgin aggregates, whatever the emulsifier nature and content :
 - Adsorption of free surfactants on aged binder of RAP by their lipophilic part.
 - Lower emulsion-RAP contact angles when the emulsifier content decreases because of reduction of free surfactants in the medium.

