



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

Yacouba Konaté, Florence Rouyer, Layella Ziyani, Anne Dony, Jean-Eric Poirier, Xavier Chateau, Athanas Konin

► To cite this version:

Yacouba Konaté, Florence Rouyer, Layella Ziyani, Anne Dony, Jean-Eric Poirier, et al.. Formulation of cold recycled asphalt mixtures: a microscopic scale study of bitumen emulsion wetting on virgin aggregates and reclaimed asphalt pavement (RAP). 10th International Colloids Conference 2020, Dec 2020, ONLINE, France. hal-03207943

HAL Id: hal-03207943

<https://hal.science/hal-03207943>

Submitted on 26 Apr 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Yacouba Konaté^{a,b}, Florence Rouyer^c, Layella Ziyani^b, Anne Dony^b, Jean-Eric Poirier^d, Xavier Chateau^c, Athanas Konin^a

(a) Institut National Polytechnique Félix HOUPHOUËT BOIGNY, Bd Mamie Adjoua, 1093 Yamoussoukro, Côte d'Ivoire.

(b) Université Paris-Est, Institut de Recherche en Constructibilité, École Spéciale des Travaux Publics, 28 avenue du Président Wilson, 94234 Cachan Cedex, France.

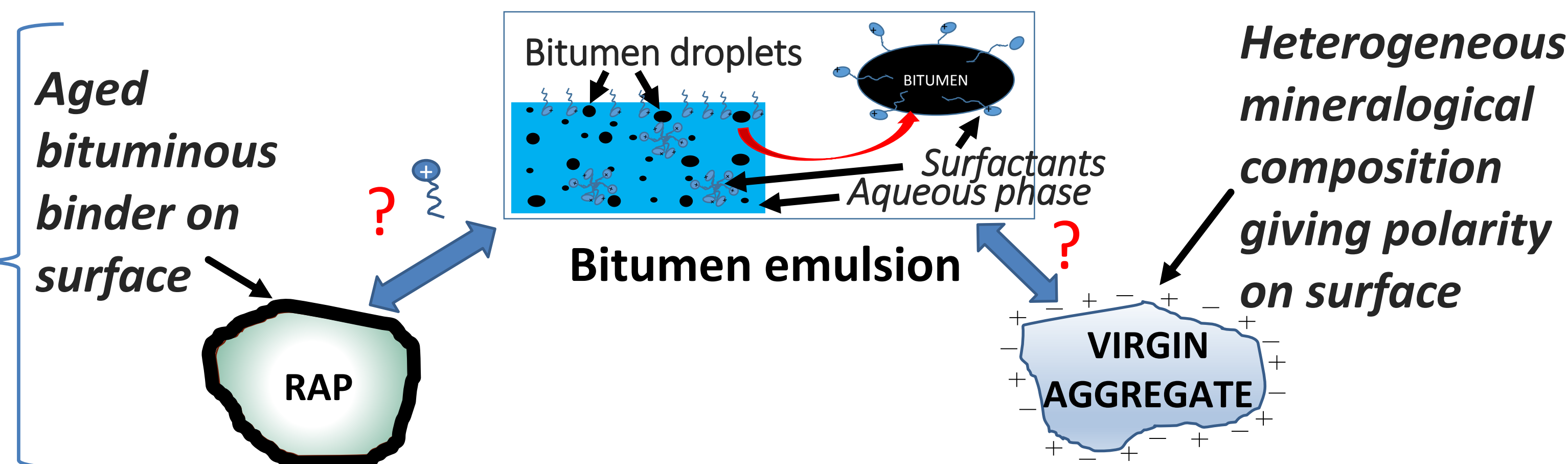
(c) Navier, CNRS, École des Ponts, Université Gustave Eiffel, 14-20 Boulevard Newton Cité Descartes, Champs sur Marne F-774447 Marne-la-Vallée Cedex 2, France.

(d) PQSERENDI, 2 allée de l'Hermine, 78180 Montigny-le-Bretonneux, France

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**.

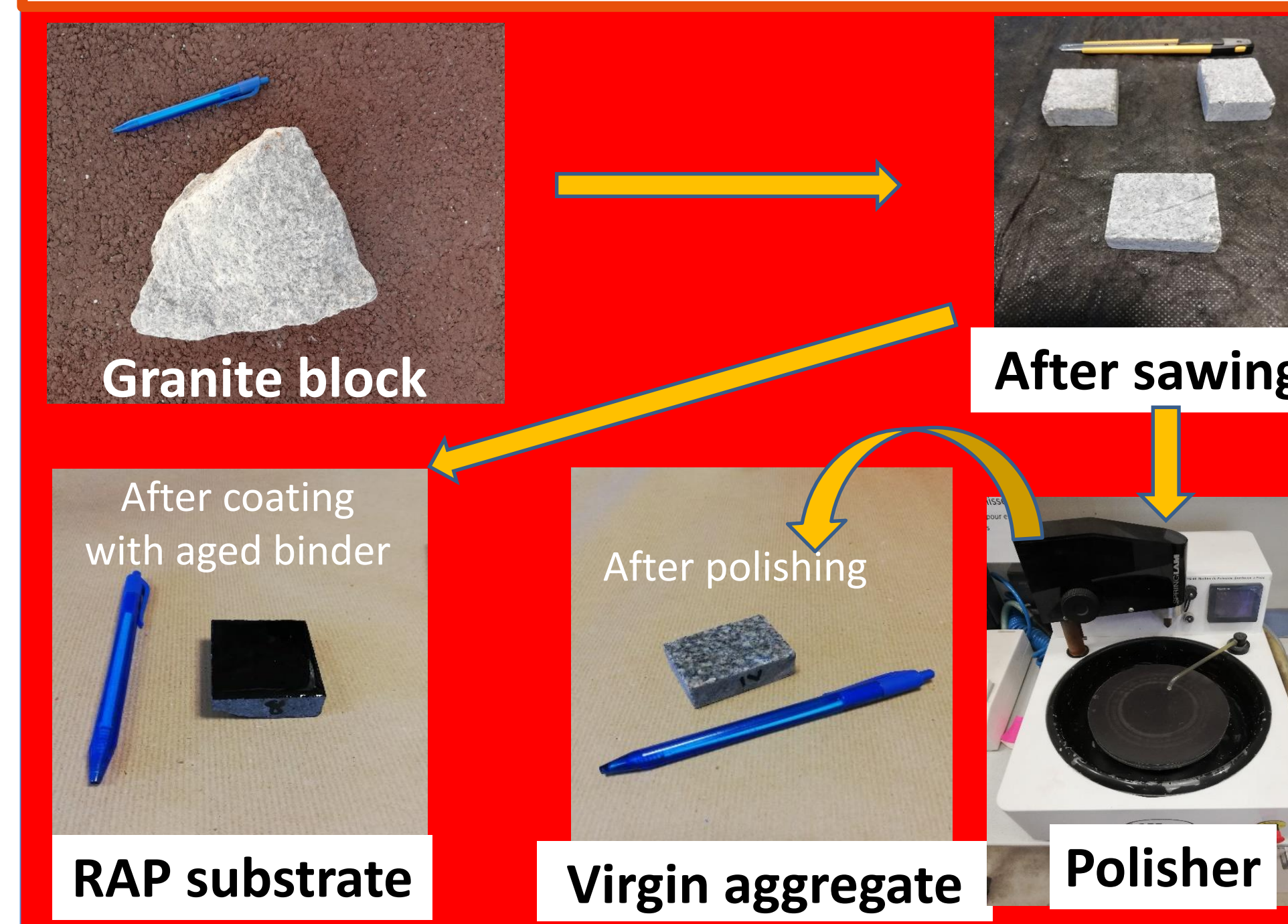
3 - METHODOLOGY AND APPROACH

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

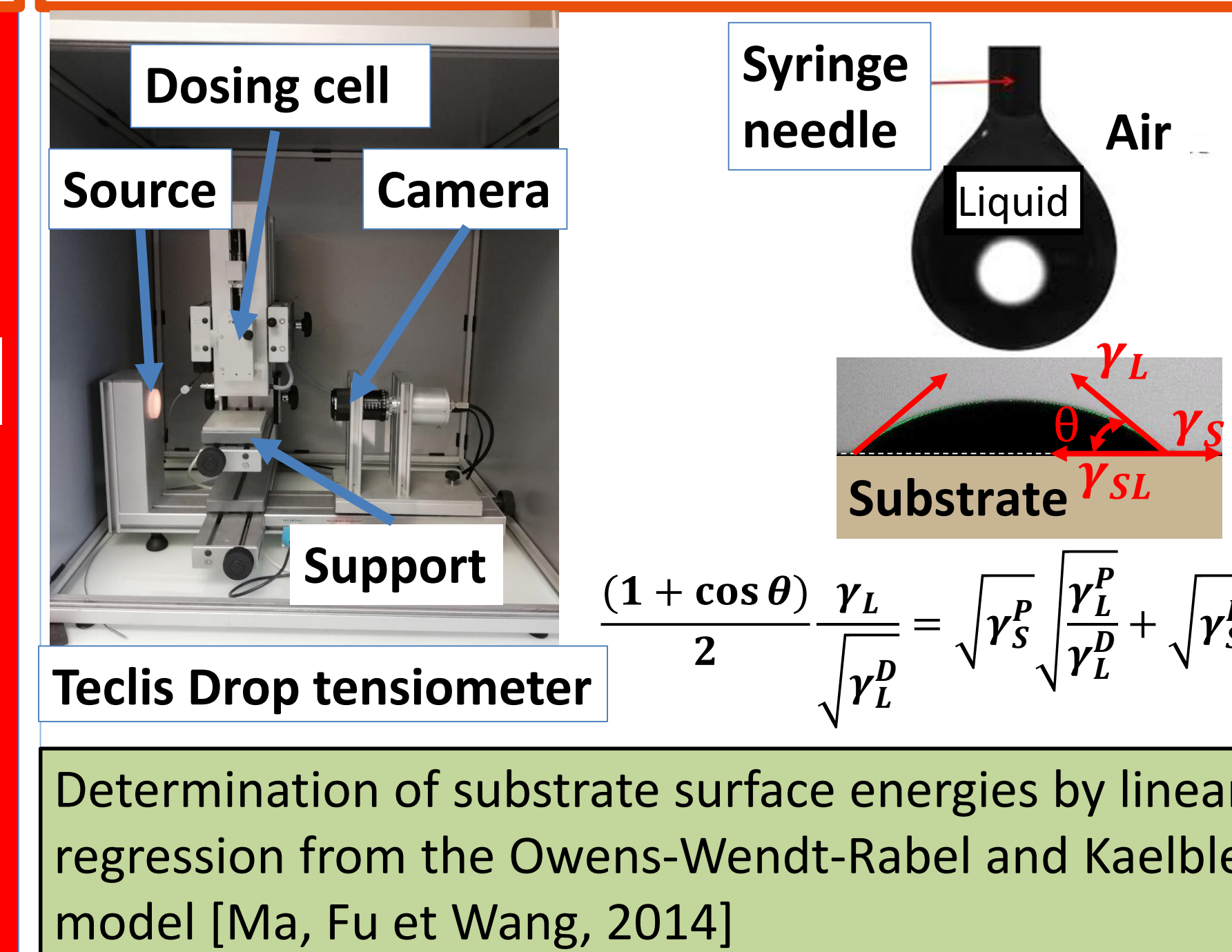
Emulsion designation	Emulsifier nature	Emulsifier content	Bitumen content
0.9 % A	A	0.9 %	65 %
1.2 % A	A	1,2 %	65 %
1.5 % A	A	1.5 %	65 %
0.9 % B	B	0.9 %	65 %
1.2 % B	B	1.2 %	65 %
1.5 % B	B	1.5 %	65 %

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

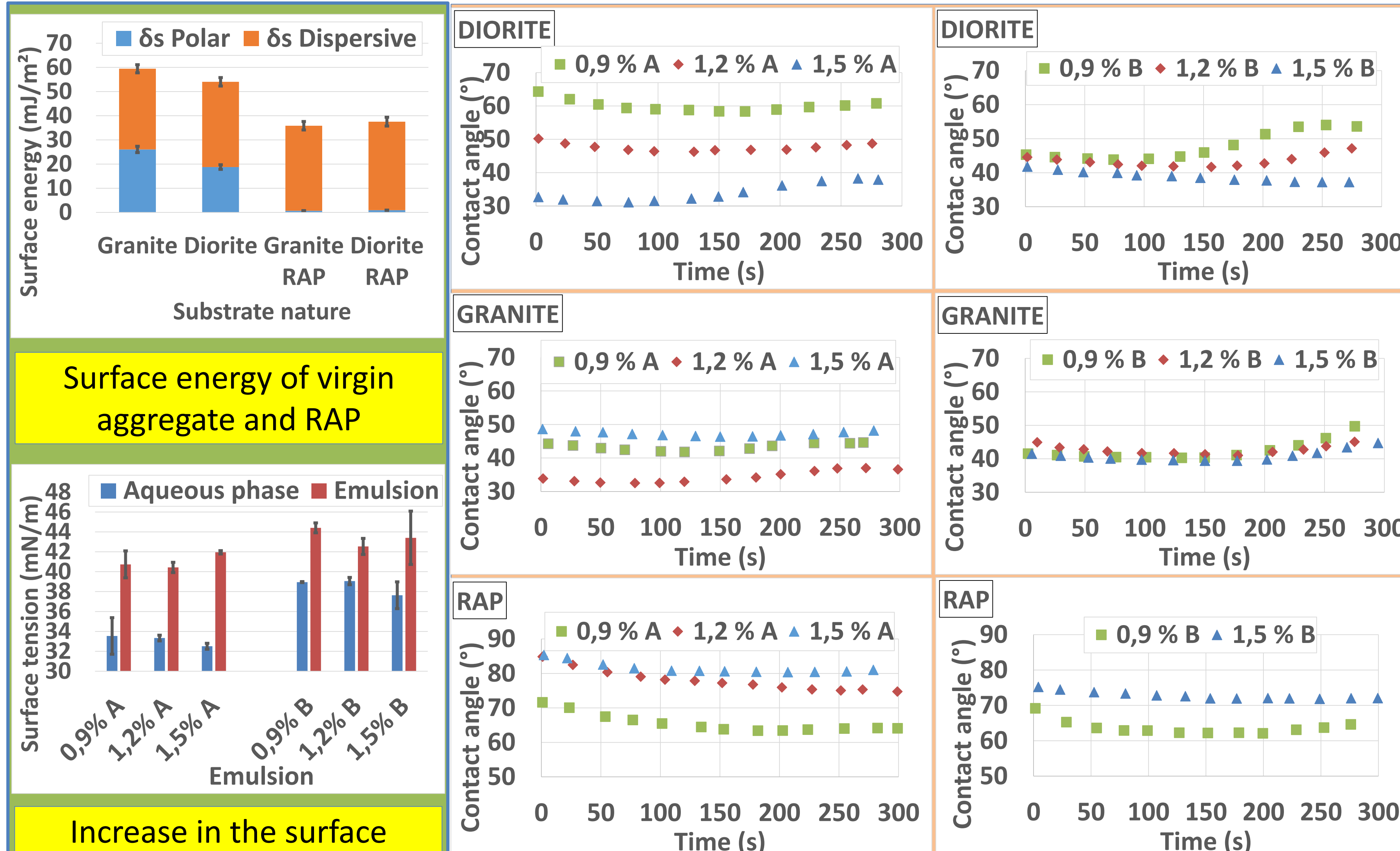
Manufacture of substrate model of virgin aggregate and RAP



Measurement of surface tensions and contact angles with drop tensiometer



4 - RESULTS



Contact angles of emulsion / substrate systems as a function of
 time, emulsion formulation parameters and the petrographic
 nature of the model substrate

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.

