POSTDOC POSITION

Relations between mixing, physico-chemical interactions and mechanical behavior of bitumen-SBS copolymer blends

Ingénierie des Matériaux Polymères IMP - INSA de Lyon, Villeurbanne, France

A 12-month postdoctoral position is available at INSA-Lyon, IMP laboratory (www.imp-umr5223.fr), in the frame of a close collaboration with Soprema and Colas Companies. This common project deals with the modification of bitumen with polymers [especially Styrene-Butadiene(-Styrene) block copolymers, SB(S)] in order to improve its thermomechanical behavior and fracture toughness.
Such blends are commonly used in road and pavement or roofing applications, to prepare materials with a better plasticity at low temperature, together with a better creep resistance at high temperature. However the results strongly depends on the nature of the bitumen, a colloidal dispersion that, depending on its geographical origin, can show highly varying chemical composition (SARA fractions) and rheological behavior.

The main goal of this project is to acquire a more systematic understanding of the relations that may exist between the final mechanical behavior of a blend, its rheological profile during blending, and the bitumen/polymer physico-chemical interactions. This could be achieved using emerging approaches, e.g. using existing and/or designing novel "rheo-reactors" to monitor the mixing phase; calculating Hansen Solubility Parameters, HSP, or using turbidimetry, interfacial tension measurements or confocal Laser scanning microscopy, together with more classical techniques like optical microscopy to assess bitumen/polymer physico-chemical interactions. Since bitumen is a dark medium, innovative experiments should also be proposed and implemented for a thorough investigation of its properties.

This methodology will first be applied to a series of bitumens with different compositions or specific features. The aim is to precisely determine their HSP parameters and, if possible, relate them to the values of the SARA or SAR-AD fractions.

In a second step, similar studies will be carried out on SBS copolymers differing by their molecular architecture (linear, di/triblock, branched or star-shaped), styrene proportion, presence and amount of 1,2-units in the polybutadiene block, etc.

The final objective is to manage to precisely assess the compatibility between any SB(S)-bitumen pair using one or two simple laboratory tests, and finally to be able to determine the optimal SB or SBS modifier for any given bitumen, in relation with the target application of the resulting binder.

Duration:	*12 months*
Net monthly salary :	*around 2 200 € (employer : Insavalor)*
Location:	*Ingénierie des Matériaux Polymères IMP, INSA-Lyon, Villeurbanne, France*
Contact :	*Jean-François Gérard, Professor (jean-francois.gerard@insa-lyon.fr)* *Françoise Méchin, CR CNRS (francoise.mechin@insa-lyon.fr)*
Industrial partners:	*Xavier Carbonneau, Colas (carbonneau@campus.colas.fr)* *Rémi Perrin, Soprema (rperrin@soprema.fr)*
Skill set required :	*PhD in Polymer Physico-Chemistry or Soft Matter Processes & Engineering, with sufficient expertise in Colloids & Dispersions*