Geophysical Research Abstracts
Vol. 19, EGU2017-7923-1, 2017
EGU General Assembly 2017
© Author(s) 2017. CC Attribution 3.0 License.

Coupling Raman spectroscopy and infrared thermography to evaluate energy exchanges with PCM embedded into pavement

Mario Marchetti (1,2), Jean Dumoulin (3,4), Laurent Ibos (5), Jean-Michel Piau (6), Magali Fois (5), and Patrice Bourson (2)

(1) Cerema, Direction Territorial Est, Tomblaine,France (mario.marchetti@cerema.fr), (2) LMOPS/CentraleSupelec EA 4423, Université de Lorraine, Metz, France, (3) LUNAM Université, IFSTTAR – CoSys, SII, Bouguenais, France (jean.dumoulin@ifsttar.fr), (4) INRIA/IRISA, I4S Team, Rennes, France (jean.dumoulin@ifsttar.fr), (5) CERTES EA 3481, Université Paris Est-Créteil, Créteil, France (ibos@u-pec.fr), (6) LUNAM Université, IFSTTAR – MACS, Bouguenais, France (jean-michel.piau@ifsttar.fr)

Some innovative research was jointly conducted between IFSTTAR, Cerema and Universities of Paris Est Créteil and Lorraine to evaluate the energy impact of PCM embedded into pavement as a sustainable solution for both winter maintenance and summer heat mitigation. Usually, two main techniques were separately used. Raman spectroscopy and DSC helped to characterize the temperature of the phase transition and enthalpy within specific temperature variation conditions. On the other hand, infrared thermography monitored temperature variations at the pavement surface generated by the energy released or absorbed during the phase transition phenomenon. Nevertheless, there is a time phase shift which is difficult to evaluate between the moment the phase transition starts and the moment it is detected with an infrared camera. To properly identify to what extent the energy exchanges is detected and the phase shift is important or not, both Raman spectroscopy and infrared thermography were couples in one single original experiment. A PCM volume was embedded into a pavement sample. The later was thermally carefully insulated on all faces but the surface. A Raman probe was inserted into the PCM volume, while an infrared camera monitored pavement surface temperature. The whole set was submitted to air temperature variations. Raman spectra were then analyzed to identify when the phase transition took place, and thermal images when its manifestation on the surface occurred. Results were then discussed to identify the relevance of the use of PCM, while some numerical investigations conducted to search for the optimal configuration.