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Infrared Emissivity Measurements for Mineral Materials and Materials Used for Infrastructure Building

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The knowledge of the infrared emissivity of materials used in buildings, civil engineering structures and soils studies is useful for two specific approaches. Firstly, quantitative diagnosis of buildings or civil engineering infrastructures using infrared thermography requires the emissivity value of materials in the spectral bandwidth of the camera. For instance emissivity in the band III domain is required when using cameras with uncooled detectors like micro-bolometers arrays. The knowledge of emissivity is in that case needed for computation of surface temperature fields. Secondly, accurate thermal balance requires the emissivity value in a large wavelength domain. This is for instance the case for computing roads surface temperature to predict ice forming. A measurement of emissivity just after construction and a regular survey of its variations due to ageing or soiling of surfaces could be useful in many situations like thermal mapping of roads or building insulation diagnosis. For mineral materials, a lot of studies exist, but often in situ value of emissivity could be different. Mineral materials are not pure, and could be soiled. Real value obtained with a field device is required. The use of portable emissivity measurement devices is required for that purpose. Thus, two devices using the indirect measurement method were developed. The emissivity value is deduced from the measurement of the reflectivity of the material under study after calibration with a highly reflective surface. The first device uses a slow modulation frequency well adapted to laboratory measurements whereas the second one is a portable system using a faster modulation frequency authorizing outdoor measurements. Both devices allow measurements in broad band (1 to 40μm) and band III (8 to 14μm). Experiments were performed on a large number of materials commonly used in buildings and civil engineering structures. For instance at that time 180 samples of different pavement wearing course samples (i.e. different aggregates source), have been characterized. The final objective of this work is to be able to fill a database of emissivity of these materials. A comparison of laboratory and on site measurements and of emissivity values obtained in both broad band and band III will be presented along with an estimation and analysis of measurement uncertainties.