

Ph.D. defense

Institut de Chimie Séparative de Marcoule / CEA Marcoule
(UMR 5257, CEA, CNRS, Université Montpellier, ENSCM)

MOUSTAPHA COULIBALY

will present his Ph.D. dissertation

Nanocomposites Carbides from Sol-Gel Precursors Impact on the Optical Selectivity

The defense will take place on **Thursday, December 17, 2015 at 10.00 am**
in the ICSM Auditorium

Transition metal carbides (MC) belong to the category refractory materials. They have an intrinsic optical selectivity, which is characterized by a high absorbance in the UV-visible region and a low emittance in the infrared range. This feature is at the origin of many studies on these materials where they were expected to play the role of absorber in a Concentrating Solar Power plant (CSP). However, given the operating temperatures of such devices (beyond 1000 ° C), the transition metal carbides have a major limitation related to their relatively low resistance to oxidation. The idea of this study is to associate such material to the silicon carbide (SiC), which currently is used as absorber in CSP systems due to its good thermomechanical properties and resistance to oxidation (up to 1400 ° C). Therefore, the first part of the experimental approach consisted in the identification among a series of carbides (HfC, ZrC and TiC) the one presenting the best characteristics in terms of optical selectivity. Then, in the second part of the study, many synthesis routes (molecular, semi-molecular and colloidal) implementing different metal precursors (alcooxydes and colloidal solution) and a carbon source (sugar) were studied according to their ability to conduct to SiC-MC type composites. The influence of the experimental parameters as well as the one of the chemical composition has been investigated. The aim was first to evaluate the ability of each synthesis routes to conduct to the expected phases and also their impact on the microstructure and the optical properties. These latter have been first studied on powders in order to discriminate the samples on the base of their compositions and then the analysis has been made on densified materials by HP or SPS. This research has permitted to conclude that the combination of a transition metal carbide with silicon carbide conduct to a composite MC-SiC presenting a certain spectral selectivity and that such a material could play the role of absorber in CSP system.

Keywords: Nanocomposites; Carbides; SiC; Optical Selectivity

