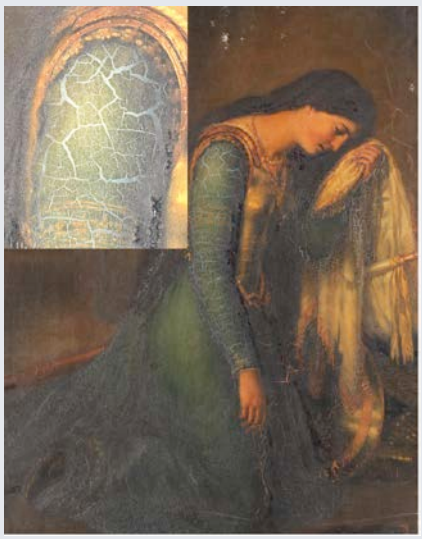
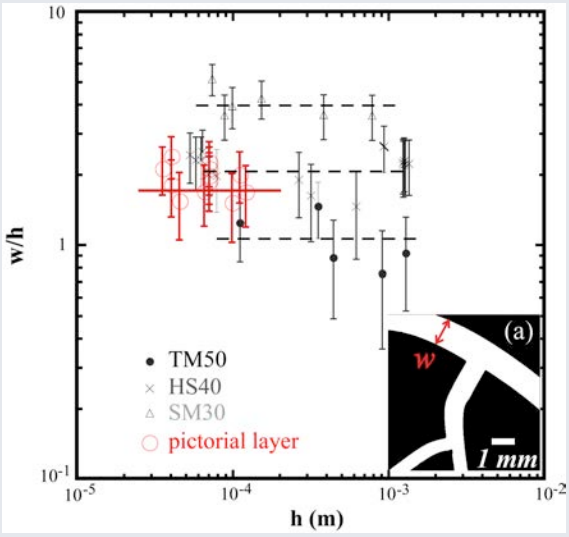
Crack opening : from colloidal systems to paintings

M. Léang, F. Giorgiutti-Dauphiné, L. Pauchard (FAST)

Shrinkage cracks are observed in many materials, such as polymer coatings, colloidal systems and in paintings where great interest lies in deducing quantitative information on the material with the aim of proposing authentication methods. We have conducted experimental measurements on the crack opening induced by the drying of colloidal layers and compare these results to the case of a pictorial layer. We propose a simple model to predict the crack width as a function of the thickness of the drying layer, based on the balance between the drying stress buildup and the shear frictional stress with the substrate. Key parameters of the model include the mechanical properties that are measured experimentally using micro-indentation testing. A good agreement between theory and experimental data for both colloidal layers and the real painting is found. These results, by comparing the shrinkage cracks in model layers and in pictorial layers, validate the method based on the use of colloidal systems to simulate and to reproduce drying cracks in paintings. The modeled systems are drying layers of colloidal particles with three different diameters.



Photograph in visible light of the painting "Jeanne d' Arc en prison" by Louis Crignier (1824) – Musée de Picardie, Amiens, © C2RMF/A. Maigret. Inset: Detail of the shoulder showing a drying crack pattern



Width of a crack, w, dimensioned by the thickness h of the layer for three different colloidal systems and a pictorial layer. The dashed and plain lines correspond to the model and fit well the experimental results both for colloidal systems and paintings

M. Léang, F. Giorgiutti-Dauphiné, Lay-Theng Lee and L. Pauchard, *Crack opening: from colloidal systems to paintings,* Soft Matter 34 (2017)

Résultats obtenus dans le cadre du projet DEEPPAINT financé par le thème 2 du LabEx PALM et porté par Frédérique Giorgiutti-Dauphiné (FAST, CNRS) et Lay-Thang Lee (LLB, CEA).